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Infectious Diseases.

PART I.

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Pathology and Treatment of the Infection

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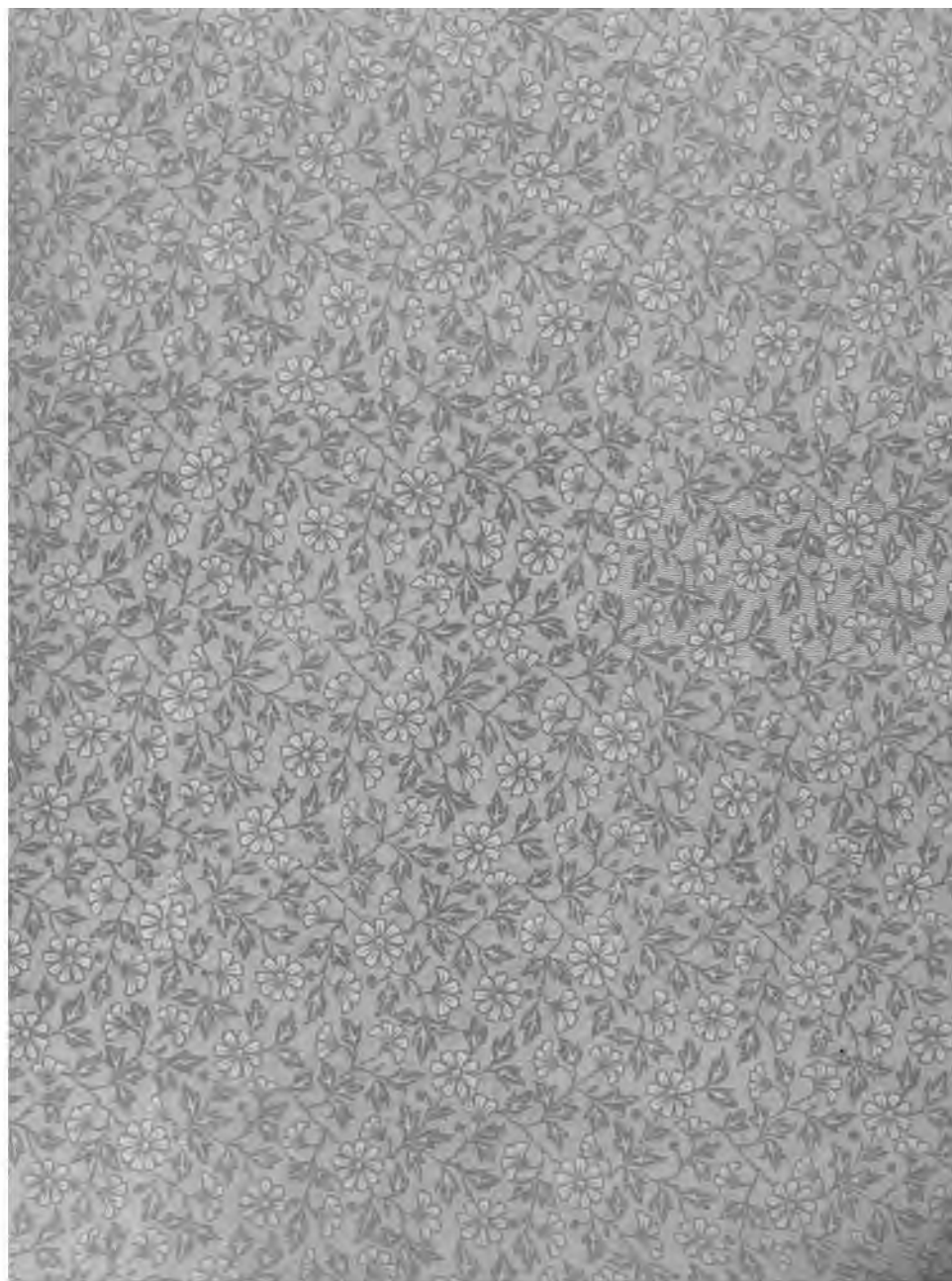
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PATHOLOGY AND TREATMENT
OF THE
INFECTIOUS DISEASES.

PART 1.

The Miasmatic and Miasmatic Contagious Diseases:

Intermittent Fever, Typhoid Fever.

—BY—

PROFESSOR KARL LIEBERMEISTER,

Professor of Clinical Medicine in Tübingen, Germany.

TRANSLATED BY

E. P. HURD, M. D., Newburyport, Mass.

WITH NOTES AND APPENDICES.



1888.

GEORGE S. DAVIS,
DETROIT, MICH.



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TRANSLATOR'S PREFACE.

If the animated pathology—to use a term with etiological connotation current on the Continent—shall ever make good its right and title to the vast morbid territory which it claims, (it has already appropriated pneumonia and all the infectious diseases, syphilis, cancer and tuberculosis being included), there will be little left for the nosologist but to classify his disease according to the microbe that produces it, and as the causal agent is presumed to be a bacterium, every chapter in special pathology will appropriately begin with a zoological treatise on some one of the numerous malignant micro-organisms.

That day has, however, not yet come, and the number of micro-organisms whose causal relation to particular diseases has been proved, is still relatively limited.

We must not forget that the acquisitions actually made in the knowledge of the true causes of the specific febrile maladies are still meagre. The inference is indeed irresistible that if anthrax (splenic fever) and perhaps sheep-pox and swine-plague, be of bacillary origin, the other malignant infectious diseases are equally so, but we are warned that it will not do to press the analogical argument too far, or to make too large inductions from the facts already in our possession. We have a right to conclude from the data already acquired respecting anthrax, that all cases of this disease wherever occurring are bacillary, but we are not justified from these data in affirming that the bacterial nature of the *materies morbi* of typhoid fever, diphtheria, scarlet fever, is proved. We can only say that such conclusion is very probable, in fact more probable in the present state of science than any

VI.

other. But for each specific disease the problem of causation must be worked out independently, as has been done for anthrax.*

We should not, however, overlook the fact that researches made the past few years in the domain of poisonous alkaloids (ptomaines and leucomaines), toxic products of the decomposition, under peculiar circumstances, of food substances in the alimentary canal, or of waste tissue elements in the deeper recesses of the organism, and the definite knowledge which has been obtained of the physiological effects of these alkaloids when retained in the system, have tended somewhat to curtail the rôle ascribed to the micro-organisms, and if in any given case the morbid syndrome is still referred to microbes, it is rather by promoting these toxic decompositions than by any direct irritant or destructive influence that these "infinitely little" parasites are supposed to act.

Professor Karl Liebermeister, of Tubingen, is one of the most uncompromising adherents of the germ theory of disease, and in the work on Infectious Diseases from which the present treatise is taken, the fruits of twenty-five years of earnest study and careful observation are given. Two chapters only of this work are here presented, those pertaining to Malaria and Typhoid Fever. Part II will be occupied with the Con-

*According to Hallopeau (*Traité Élémentaire de Pathologie Générale*, Paris, 1887), the infectious diseases of animals and men in which the causal agent is known to be a definite microbe, which has been discovered, are the following: Pebrine and flacherie (silk worm); chicken cholera; the contagious acne of the horse; sheep-pox; pigeon-pox; the swine-plague; anthrax, or splenic fever; symptomatic charbon; purulent infection and septicæmia; erysipelas; ulcerous endocarditis; gonorrhœa; the Peruvian wart; diphtheria; pneumonia; recurrent fever; typhoid fever; cholera; tuberculosis. The above comprehends but a part of Hallopeau's list, but the diseases mentioned are those of which he considers the microbiotic nature of the casual agent best established.

VII.

tagious Diseases: Small-pox, Vaccine, Varicella, Rubella, Measles, Scarlet Fever, and Diphtheria.

On account of the small size of these volumes, which were designed not to exceed 150 pages each, and the especially practical character which it is the intention of the publisher to give them, it was found necessary to omit in the present translation the long preliminary chapter on "The Nature of Infection, etc." Those of the readers of this series who can have access to the first volume of Ziemssen's *Encyclopædia* (Wm. Wood & Co.) will find under the head "Introduction to the Infectious Diseases," a lucid and full presentation of the author's views on this subject in general, while the twelve years which have elapsed since the publication of that work have added much that is illustrative and confirmative of the positions there taken.

As appendices to the chapter on Malaria, I have added some notes setting forth more particularly the American method of treating intermittent fevers; and as appendices to typhoid fever, I have presented some considerations relative to the cold bath treatment of typhoid, a disease whose pyrexia, I believe to be most successfully combated by antithermic medicines, such as antifebrine and especially antipyrin. I have also borrowed from the *Medical News* an exceedingly valuable summary of the treatment of typhoid fever in some of our principal hospitals.

TRANSLATOR.

NEWBURYPORT, MASS., April 1st, 1888.

INFECTIOUS DISEASES.

CHAPTER I.

MIASMATIC DISEASES—MALARIA.

Under the name of miasmatic affections we designate all infectious diseases of which the specific excitant originates from without, and is not conveyed by contact from a previously diseased organism. The essential character of miasm is that it does not need to pass through a phase of parasitism in order to accomplish its evolution. It may undergo its development and multiply itself indefinitely in regions where no human or animal organism exists capable of being infected by it. The introduction of the miasmatic agent into the economy, and its consequent parasitic existence are, so to speak, accidental circumstances. This it is which distinguishes miasmatic agents from those which cause the contagious and miasmatic-contagious diseases, whose propagation is largely, if not altogether, effected during the period in which they live as parasites in the human or animal organism.

To this group belong, in the first place, all the infectious micro-organisms that are ubiquitous.* The

* "Ubiquitous" microbes are such as are everywhere found, *i. e.* like the bacteria of putrefaction of organic matters. Such also are the bacteria found in connection with septicæmia.

The pathogenic agents of malaria, as well as of the mias-

notion of ubiquity implies that of existence in some sort independent of man and of animals. The agents of such communicable diseases as are contagious or miasmatic-contagious, whose life is in part parasitic, can never in fact be completely ubiquitous.

Apart from these ubiquitous microbes, there are also certain others which are really miasms in the sense that their existence is quite independent of the presence of man and of animals, but which, like the malarial poison, demand for their development and multiplication particular conditions, which are not everywhere met with, and which limit the habitat of these micro-organisms to certain determinate regions.

We shall confine ourselves in the present treatise to the study of malaria, leaving one side the other miasmatic affections. But we ought to say that, to be strictly logical, we should comprehend in this group simple and malignant mycosis, infectant (vegetative) endocarditis, osteo-myelitis, acute rheumatism, croupous pneumonia, the specific catarrhs, and various neoplasms due to micro-organisms. In accordance with medical usage, however, we opine that a consideration of these diseases may still better find its place under the head of local or constitutional diseases.

matic contagions, and contagious diseases are endemo-epidemic, but not ubiquitous. The ubiquitous diseases (suppurative fever, pyæmia, septicæmia, etc., are not classed among the infectious diseases, but only the endemo-epidemic are so classed.— Trans.

§I.—MALARIA—INTERMITTENT FEVER.

Under the name of malaria, and of marsh diseases, we understand all those morbid states which are engendered by the introduction into the system of a certain miasm—the swamp poison.

The action of this poison on man is very variable. Ordinarily the marsh infection manifests itself by attacks of intermittent fever, attacks which are violent, of short duration, and separated from each other by an apyretic period. The interval between the paroxysms is quite variable, conforming to certain types; thus we have a quotidian type of fever and ague, a tertian, a quartern, etc.

When the activity of the swamp poison is very great, the fever often takes on a grave and malignant character and is called *pernicious* fever.

The intermissions, especially in the grave forms, may be wanting, and the fever is said to be *remittent* or *pseudo-continuous*. In certain cases the action of the miasm manifests itself by periodical neuralgias, which are designated under the name of *masked ague*. Lastly, prolonged exposure to the infection may result in a grave constitutional state, the *malarial cachexia*. It is only comparatively of recent date that these divers manifestations of the malarial infection, whose symptoms and whose course are so widely different, have been recognised as having a common cause, and therefore as constituting one disease. Apart

from the etiological unity, there are, moreover, between them numerous bonds of relationship. The special action of the swamp poison on the spleen shows itself in all the forms of malaria. In the majority of cases, there is a more or less marked rhythm in the march of the symptoms. These, in fact, have regular periods of coming and going, and either completely disappear in the interval or are inconspicuous. Moreover, in all the affections dependent on malaria, quinine is a specific remedy. Lastly, the affinity between all these morbid states is further demonstrated by the frequent passage of one form into another.

The paludal fevers have been known and described from the earliest days of medicine. The old physicians, who classified diseases according to their symptomatology, did not see the bond which unites the various malarial affections. They distinguished several kinds of intermittent fever according to the period of the chill and febrile access, and excluded, as different maladies, all the other manifestations of marsh-poisoning. Since the etiological notion has been taken as a basis for the classification of diseases, all the affections caused by malaria are regarded as different forms of one and the same disease, and this constitutes, both from a theoretical and practical point of view, a considerable progress.

We shall study, then, in the following sections the malarial infection under all its manifestations, describing under the head of symptoms the divers forms under which it appears.

ETIOLOGY.

Malaria is endemic in certain regions, while other

countries are exempt from its presence. It is generally admitted that the cause of this affection is a specific poison, which undergoes development in the soil of infected localities; malaria, then, belongs to the class of miasmatic diseases.

The agent of malaria is still known to us only by its effects. While it was once regarded as a sort of gaseous principle evolved from organic matters undergoing decomposition, we are to-day led to the belief that certain micro-organisms constitute the essential element of malaria; in other words, the prevalent doctrine is that of a *living miasm*.

Former attempts (from Moscati to Salisbury in 1866) to isolate the specific agent, have now only an historical interest. The experimental observation of Klebs and Tommasi Crudeli (1879), however, merit a more serious attention. If we may be permitted to entertain some doubt as to the importance of the rôle of the *bacillus malaria* which these observers have succeeded in cultivating, nevertheless, the hypothesis that the cause of malaria is a micro-organism has all the probabilities in its favor, and it has the advantage over all other hypotheses, of better explaining the etiological conditions of the disease.

Some authorities on altogether insufficient evidence, have asserted the propagation of the malarial infection by contagion. This we may set aside as unproved, while, at the same time, the propagation of the specific germ to localities hitherto exempt from it by the intermediation of a patient suffering from the disease, does not seem to be improbable. Quite recently Gerhard has succeeded in producing an access of fever in a healthy individual by the subcutaneous injection of blood taken from an ague patient at the moment of the febrile paroxysm.

The disease ordinarily breaks out in places where

an active decomposition of organic substances is going on, and especially vegetable substances. Heat and moisture favor decomposition, and thus promote the development of malaria. The necessary conditions, then, are on the one hand an exuberant vegetation, and on the other, an active decomposition of dead vegetable matters, aided by heat and moisture.

It is in marshy regions that malaria prevails to the greatest extent. In proportion as the swamps are dried up, the limits of the malarial zone are narrowed, and the disease practically disappears when the marshes are completely covered with water which prevents access of air and decomposition.

Malaria, nevertheless, prevails in many localities where there are no marshes, and in particular in the vicinity of river deltas, and in regions exposed to abundant rains and an annual overflow; along the shores of certain rivers, lakes and ponds with damp bottom lands; in localities where the bed of subterranean water is very near the surface of the ground; in a word, in all places where the subsoil remains saturated with moisture the greater part of the year, without at the same time being covered with water. In many countries where malaria once raged, it has now completely disappeared, or prevails in a much milder form, since, in the ordinary processes of drainage and cultivation of the soil, the land has become dry. This is what has happened in many parts of Germany, Belgium, France, and North America.

The geological constitution of a locality and its altitude play also an important etiological rôle, by reason of their influence on the dampness of the soil and the temperature.

Besides humidity, the development of malaria demands a certain degree of heat. In general, a high temperature is a favorable condition. Miasmatic affections prevail principally, and with the greatest intensity, in the tropical and subtropical regions, and there are few localities in the torrid zone with a sufficiently damp climate where these diseases are not endemic.

In the temperate zone, malaria becomes the more infrequent and the more benign the farther you go from the equator, and it completely disappears beyond a certain latitude. A mean summer temperature of at least 15° to 16° C. is the most favorable to malaria. In Sweden and in Finland the extreme northern limit is latitude 63° or 64° ; in Asia, latitude 53° ; in the north-eastern part of North America, by reason of a lowering of the isothermal lines, this limit is latitude 42° (Hirsch).

The seasons, by reason of differences in the conditions of moisture and of temperature which they present, have a considerable influence on the development of paludal affections. In the malarial districts of the temperate zone it is, as a rule, during the winter that intermittent fever prevails the least; in spring the number of cases increase; there is a marked decline

of the disease during the dry weather of summer, with a rise and exacerbation in the fall. In tropical countries the maximum of prevalence is ordinarily at the beginning of the rainy season.

Meteorological conditions have an action which varies according to localities, and may be likened to the influence which these conditions have on vegetation in general. In the swampy regions of the northern zone, a warm and dry summer is favorable to malaria, while abundant rains, which cover with water tracts previously half submerged, prevent the evolution of the morbid agent. On the other hand, in countries hotter and less damp, malarial diseases rage with a greater intensity when the rains are abundant. Often a great extension of the miasmatic territory—a real spreading epidemic of malaria, has resulted from an abnormal rain fall, or from great freshets. There is here, however, a distinction to be made. If the overflow of a country is favorable at a later period to the outbreak of malaria, it prevents the action of the miasmatic influence as long as the ground is covered with water.

There are some exceptions to the rule that malaria is endemic only in places where the soil is very damp, but these exceptions are rare if compared with cases in which the rule holds good. Some, however, of these exceptions are more apparent than real. The dryness of the soil may be only a surface dryness, and at a little depth may be found stagnant beds of water, real underground marshes, as is observed in some regions of Sicily and in certain oases of Sahara. Nevertheless, in certain other localities the existence of malaria seems a veritable anomaly, quite in contradiction to the law

laid down. Such, for instance, are the high table lands of Castille, where the dryness is excessive, the elevated plateaux of Dekkan in Hindostan.

On the other hand, we are acquainted with some marshy regions where malaria never prevails, although all the favorable conditions seem present; for instance, the mouth of the Rio de la Plata, several islands of the southern hemisphere, Van Dieman's Land, New Zealand, Caledonia, some parts of Ireland and Sweden. These facts show that the decomposition of vegetal substances alone does not suffice to engender the disease, and that it is essential that the specific germ shall have a habitat in the soil of the infected localities. Some observations, moreover, seem to prove that the disease may be imported into countries heretofore exempt, and this furnishes a new argument in support of the hypothesis of a *miasma vivum*.

It is chiefly in the tropical and sub-tropical regions of Asia, Africa, and America, that we see the most grave forms of marsh poisoning. We, however, observe the disease take on a very severe aspect in some countries of Europe, and even a pernicious character. This is the case along the valleys of the Po, in certain parts of the western coast of Italy, and in some districts of Holland, in the swampy, low lands bordering on the North Sea in Germany. The light forms are also seen in these localities along with the grave types, just as is the case in countries where the prevalent type is mild.

It has often been remarked that epidemics of intermittent fever not unfrequently precede or follow epidemics of typhus, of cholera, or of dysentery. Moreover, authorities have affirmed that in malarious countries, tuberculosis and typhoid fever do not exist, or at least, are very rarely witnessed.

Although in respect to many of the facts which have been cited in support of these statements, we have to do only with accidental coincidences, it is by no means impossible that

there may be a certain antagonism between the conditions which preside over the development of these divers specific affections. Hypotheses are plenty enough, at the same time, it is not yet in our power to refer to any general law the facts collected from different sources.

No antagonism between malaria, on the one hand, and tuberculosis and typhoid fever on the other, exists in reality, either from the point of view of individuals, or of localities. The only certain thing is that tuberculosis and typhoid fever are more rare in malarial regions where the inhabitants are scattered, than in localities where there is a dense and crowded population.

It is ordinarily by the respiratory passages that the poison emanating from a center of malaria and diffused through the atmosphere to a certain height, infects the organism. The air of these malarial centers is especially dangerous in the evening and night time. The marsh miasm may be transported in a horizontal direction for considerable distances, and habitually follows the direction of the winds. But the propagation of this miasm is always limited. A plantation of trees, and even a high wall suffices to arrest its spread. Some observations tend to show that the disease may also be communicated by drinking the water of marshy localities.

Feeble individuals are more liable to contract the disease than those that are strong. All debilitating influences: insufficient food, chilling, over-work, excesses of all kinds, a bad state of the general health, increase the predisposition to the disease. Neither age nor sex seems to have any marked influence. The

meaning of the fact that the greater proportion of the victims of malaria are men in the vigor of life is undoubtedly this, that this class of persons is most exposed to the action of the miasm.

The question of race has some importance, for the negroes are much more refractory to the disease than the whites. In malarious countries, newcomers ordinarily suffer much more severely from attacks of ague than the inhabitants of the country who have become acclimated. A first attack of the disease, far from diminishing the susceptibility thereto, as is the case with other contagious diseases, makes the individual more liable to future attacks.

The time that elapses between the moment of infection and the appearance of the first symptoms, i. e., the period of incubation, is ordinarily from six to twenty days; but this period is in some cases shorter than six, and in others considerably longer than twenty days. The outbreak of the symptoms is sometimes determined by an accidental occurrence, as an error in diet, or a sudden cold.

An individual who has contracted ague in a malarious country is for a long time liable to relapses, even after he has left the infected region.

PATHOLOGICAL ANATOMY.

The most constant anatomical lesion of the marsh poison is the augmentation in the size of the spleen. This increase of size may in ordinary cases amount to double or quadruple the normal volume. In children, the tumefaction of the spleen is always considerable; in old people, in whom the fibrous envelope of this organ is very thick, the hypertrophy is much less marked, and may be wanting. When the infection dates back to a remote period, the spleen may have attained a weight of from three to six kilogrammes, forming in the abdominal cavity a solid tumor "ague cake," which may even extend to the symphysis pubis. In general, the tissue of the spleen does not present any abnormal element. The tumefaction is exclusively due to hyperæmia; later, there always exists a certain degree of hypertrophy of the anatomical elements.

The spleen at the outset is softer than natural, and when the swelling takes place very rapidly, as is the case in the grave forms of the disease, some of the blood-vessels may give way with hemorrhagic extravasation; quite exceptionally there is rupture of the spleen and sudden death. At a more advanced period, the splenic parenchyma becomes hard and resistant, owing to hypertrophy of the fibrous stroma, is smooth on section with oozing of a little blood, and

the cut surface bears considerable resemblance to the parenchyma of the liver.

At the onset of the disease, the spleen generally returns after the access to its normal volume, but when the disease is of long standing, this return to the normal state is never completely effected, and the tumefaction persists in the interval of the attacks. In infections of long duration, the liver is apt to participate in this hypertrophy.

As a consequence of the grave forms of malaria, there is often an abundant formation of dark pigment, due probably to destruction of the red globules. This globular destruction takes place principally in the spleen, but also to some extent in the liver, nervous centres, marrow of the bones, and lymphatic vessels. This pigmentary disintegration is called melanæmia. The spleen presents in these cases, on section, a slate-gray or steel-blue color.

Microscopic observation discloses this pigment matter in little granular masses or flakes, not only in the splenic pulp and cells of lymphatic glands generally, but also in the connective tissue and walls of the blood-vessels. In the blood, the pigment is found in the form of fine granules, sometimes isolated, sometimes agglomerated, and it is not a rare thing to see these granules enclosed within the white corpuscles. Sometimes the capillaries of the brain, nerves, and other organs, are invaded by this pigment.

In cases where the attacks of fever have been

very severe and of long continuance, there has also been observed fatty degeneration of different organs, the liver, nerves, heart and striated muscles; alterations, moreover, which are met with whenever there is prolonged hyperthermia.

In some cases there have been observed as complications, certain lesions of which I shall speak farther on.

SYMPTOMS.

1. The simple intermittent fevers (*febris intermittens*) are characterized by a series of febrile paroxysms which succeed one another in regular rhythmical order.

The febrile access consists in an ordinary pyrexial movement which is distinguished from the fever attending most other diseases by its violence, on the one hand, and its rapid evolution on the other. Its principal character is a pretty high elevation of the temperature, which during the paroxysm sometimes attains 40° to 41° C. (104° to $105\frac{1}{2}^{\circ}$ F.) and may even, in very violent attacks, mount up to 42° C. ($107\frac{1}{2}^{\circ}$ F.) The temperature remains for some time at this height, then rapidly falls to the normal level.

While the internal heat thus rapidly rises, the peripheral arteries contract, the blood is driven from the cutaneous surface which grows pale and becomes cold, and the patient experiences violent chills (*stage of chill*).

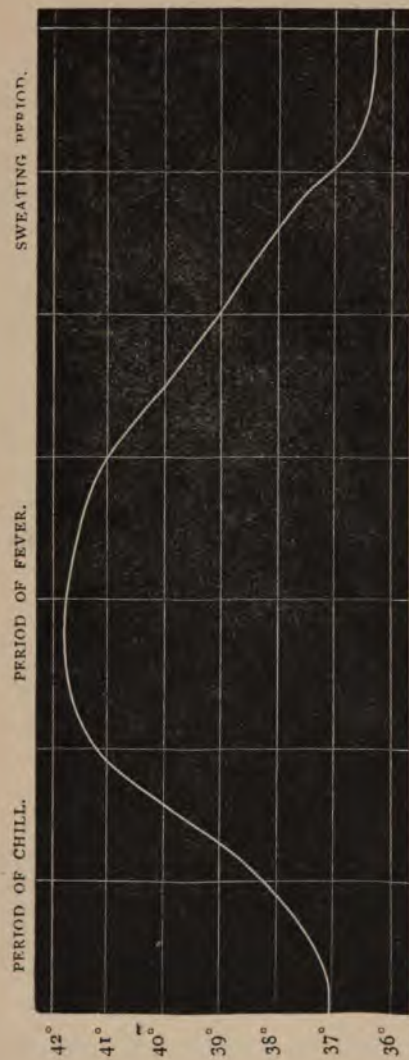


FIG. I.

DIAGRAM SHOWING THE MARCH OF THE TEMPERATURE IN AN ATTACK OF INTERMITTENT FEVER.

When the temperature has attained, or nearly attained its maximum, and while it remains stationary, the arterioles of the periphery regain their natural calibre, the blood-flow returns to the skin, the heat by degrees comes back, and to the sense of cold succeeds one of pungent and dry heat (*stage of heat*).

Lastly, in proportion as the temperature falls and the cutaneous arterioles dilate, an abundant secretion of sweat appears (*stage of sweating*). Then the fever subsides, and the apyretic period arrives (*stage of apyrexia*).

From the standpoint of pathological physiology, we may explain the phenomena of the access in this way. The specific cause of the fever acts first on the center of heat regulation, so that the bodily temperature no longer stays at the normal but at a higher degree, and regulation is equilibrated at that degree; in other words, the norm of temperature is reset. There is, in other words, under the influence of the poison, a modification in the regulating centre whereby the production of heat and its loss are so balanced as to create and maintain, while the pyrexia lasts, a higher temperature, instead of the normal temperature.

On the one hand, there is augmented production of heat, to which, among other causes, the muscular contractions and convulsive shocks provoked by the chill contribute. This heat production during the cold stage, as estimated by the calorimeter, may

amount to double or treble the normal. To this increase of temperature corresponds a proportional increase in the quantity of carbon dioxide exhaled. On the other hand, owing to contraction of the blood-vessels, less warm blood is brought to the surface of the body to part with its caloric, and hence the heat-expenditure is reduced to its minimum; this powerfully contributes to the rise of the internal temperature.

During the hot stage, the organism, in order to keep up the temperature of the preceding stage, requires only the production of an amount of heat a little above the normal; hence it is that the exhalation of carbonic acid is only a quarter more than in the normal state. Finally the heat regulating mechanism regains its natural equilibrium, and all the influences under the control of this mechanism act in rapidly bringing down the excessive temperature to the ordinary healthy standard. There is a cessation of the abnormal heat production, and heat-distribution and heat expenditure are facilitated by the relaxation and opening of all the vascular and secernant sluice-ways of the economy. The peripheral vessels dilate, and the tegumentary surfaces are flushed with blood; there is an abundant secretion of sweat, whose evaporation conduces to the lowering of the surface temperature. It should, moreover, be remarked that the impairment of the heat-regulating mechanism is not abruptly, but gradually brought about.

The physicians of olden time thought that the chills during the cold stage were an indication of a considerable fall of the internal temperature of the body. More precise researches on this point have shown that in this stage the internal temperature is considerably higher than the natural (Hæn, 1760; G. Fordyce, 1797; Gavarret, 1839), and that the more violent the chills, the higher is the internal heat. At the same time, the sensation of cold is not purely subjective as has often been affirmed as an inference from these researches. There is in reality during this stage a notable lowering of the temperature of the periphery, owing to spasm of the vessels.

From numerous thermometric diagrams taken in my clinic, the following (Fig. 2) indicates the rectal as compared with the cutaneous temperature (taken in the hollow of the hand) of a patient during the period of chill.

The other symptoms of the access are but the consequence of the condition which we have been considering.

The stage of chill is often preceded by certain prodromes, such as a feeling of discomfort, lassitude, heaviness or pain in the head, yawning, stretchings of the limbs, pains in the back, pallor of the face. Already, during the prodromic period, the temperature begins slowly to rise and may attain two or three degrees.

The first stage begins by a subjective sensation of cold, by shiverings and trembling, alternating sometimes at the onset with momentary flushings of heat. In proportion as the temperature rises, the feeling of chilliness becomes more keen, and may be so intense as to be very painful, and this despite the thickest bed



FIG. 2.
CURVE OF THE RECTAL TEMPERATURE AND THAT OF THE HOLLOW OF THE HAND DURING AN
ATTACK OF INTERMITTENT FEVER.

clothes, and other artificial means of warmth with which the patient is supplied. The teeth chatter, the limbs tremble, and the whole body is shaken in bed; children and highly susceptible nervous persons many even have clonic or tonic convulsions.

The radial pulse is frequent, hard and small; the face is pale and sunken, the lips, ends of the fingers and toes are blue; over the general surface of the body the integument is cold, pale and dry. So little blood goes to the extremities, that a prick is attended with little or no oozing of blood. Owing to spasmodic contraction of the muscles of the skin, the phenomenon known as goose flesh is produced. The cutaneous sensibility is notably diminished. The respiration is hurried and sighing, the voice broken and tremulous, the mouth dry. The patient suffers from anxiety and depression, has more or less headache, and sometimes vomits during this stage.

The cold stage lasts, on an average, about an hour; in light attacks the duration may be much shorter. When it is longer, the symptoms are also less violent, the rise of temperature taking place more slowly. The transition to the hot stage comes about gradually. The shiverings cease, the feeling of warmth returns, and eventually becomes permanent. The arteries of the periphery dilate, the pulse grows full and strong, but keeps a certain degree of hardness. The skin is now flushed with blood, and the subjective sensation is one of pungent heat. The

headache and the sense of oppression remain. The patient feels an intense thirst, is restless and excited, often manifests a slight delirium from which he is easily aroused. In certain cases which are particularly grave and of long duration, there may be profound intellectual disturbances.

The duration of the hot stage is very variable. In mild cases it is only one or two hours; in violent attacks it may last six or eight hours, and even more.

The sweating stage manifests itself after the internal temperature has begun to fall. The skin becomes moist in places, and gradually the whole body is bathed in an abundant perspiration. The vessels of the surface dilate, the pulse is frequent, full, and soft, the skin is red and flushed. The headache and oppression disappear, and the patient feels very much relieved, although still complaining of weariness and thirst; sometimes a tranquil sleep supervenes.

The duration of the sweating stage is ordinarily much longer than that of the cold stage. The more rapidly the temperature falls, the more copious is the sweating.

During the apyrexia, the temperature ordinarily sinks below the normal. If the apyrexia is pronounced, the patient feels quite well, experiencing only a little exhaustion, lassitude, and inability to engage in any active work, and is very sensitive to changes of temperature.

The secretion of urine during the cold stage,

which corresponds to spasm of the peripheral vessels and augmentation of the blood pressure, is often augmented; the urine is watery and clear. During the hot stage, and for a stronger reason, during the sweating stage, the urine is scanty, concentrated, and deposits on cooling abundant sediments of urates. The quantity of urea is increased during the access, as it always is when there is an augmentation of the temperature of the body, and there is an exaggerated elimination after the access is over.

The exhalation of carbonic acid during the access has something special connected with it. It was formerly taught that the excretion of carbonic acid during fever augments with the temperature, that, in other words, the continuance of the stationary period of the fever was characterized by increased production of this substance. This view has not stood the test of experiment, as my researches go to show. These researches have proved that there is no augmentation of carbonic acid except in the first period of febrile affections; afterwards the augmentation gives place to diminution. Thus, during the cold stage, while the temperature mounts up rapidly, the exhalation of carbonic acid is considerable, and reaches its maximum when the heat curve has attained its highest point or fastigium. But during the hot stage, while the temperature remains at the same degree, the carbonic acid exhalation diminishes, and is but a little above the normal. It would seem that the human body, in

order to pass from the normal to a temperature much more elevated, requires an exaggerated heat production, while in order to maintain this higher temperature a quite moderate thermogenesis is sufficient. In the sweat stage when the temperature falls, the carbonic acid excretion gradually becomes normal.*

The spleen sometimes augments in size during the access, and shrinks again to its natural volume during the apyretic period.

A certain irregularity is frequently observed in the course of the attack. Thus it may happen that the temperature in the cold stage shall not manifest a steady continuous rise, but mount up by successive jumps. During the hot stage the temperature may oscillate, sinking for a moment or two, then rising. In the sweating stage, moreover, the fever-fall may take place irregularly and by jerks. At other times, the temperature after having considerably fallen, takes a new rise, and at the same time all the symptoms of the cold stage reappear.

We distinguish, according to the rhythm in which the attacks succeed one another, a *quotidian fever*, in which the paroxysms recur every day; a *tertian*, in which they recur every second day; a *quartan* in which the interval is three days. There is even a five, seven,

* See the details of the author's experiments in *Deutsches Archiv. für Klin. Med.* vol. VIII, 1871, p. 153. [The carbon-dioxide production is really proportional to the heat-production during the same time.]

eight day rhythm (*quintan*, *septan*, *octan intermittent*). Where the malarial infection has not been very intense, the tertian variety is the most common; then, in the order of frequency, come the quotidian and the quartan. Types with longer intervals than those above mentioned are rare, and their reality, even, has been called in question.

In tertian and quartan intermittent, the paroxysm is ordinarily more violent and the temperature higher than in the quotidian.

While in most other fevers the paroxysm or exacerbation habitually takes place in the afternoon or evening, attacks of malarial fever generally come on in the morning. Often the paroxysm recurs at an earlier hour, or an hour or two later than on the previous fever day; the fever in the one case is called *anticipating*, in the other, *retarding* or *postponing*. If the anticipating or postponing process is frequently repeated, the rhythm of the fever may be changed, a tertian becoming a quotidian and *vice versa*.

The change of type is generally, however, brought about in another way. When the fever has lasted for some time according to a certain type, and the patient seems to be recovering, a relapse takes place with another rhythm. The quartan type, as is well known, is generally the result of a former infection. When the paroxysms succeed each other irregularly and without any fixed rhythm, the fever is called erratic, irregular (*intermittens erratica*.)

The expression: *intermittens tertia, quarta, etc.*, is easily understood, if we recall to mind that the old authorities were in the habit of counting in the first day as well as the last. Thus, from Monday to Wednesday they reckoned three days, from Monday to Thursday, four days, etc.

The *double rhythm* of intermittent is characterized by the intercalation into one regular series of aguish attacks of another series no less regular. For instance a *double* type has been recognized (*febris duplex*), and a duplicate type (*febris duplicata*). Thus in the double tertian (*tertiana duplex*) two paroxysms of different intensity take place the same day; in duplicate tertian (*tertiana duplicata*) one attack appears one day and another of milder character the next day.

The duplicate tertian (*tertiana duplicata*) is distinguished from the quotidian only by the fact that the paroxysms differ from day to day, either by their violence or by some other character, as for instance, the hour of their appearance. In the double quartan, which I have more especially observed in my practice, there are for two days in succession paroxysms differing from each other by certain characters; the third day, there is apyrexia; then there are two fresh attacks, the one of which resembles that of the first day, the other that of the second, and so on.

Authorities formerly multiplied these types still more, and even came to conceive of an intermittent type applicable to all fevers, by virtue of this notion of varieties more or less complicated. The *semitertian type* (*hemitritæus*) of which

so much was formerly written, was only a duplicate tertian or quotidian; the term hemitritæus was afterwards applied to typhoid fever. If the paroxysms are of long duration, or succeed one another very rapidly, it may happen that one paroxysm shall not be finished before a second commences; there is then no period of apyrexia, and the fever is in reality remittent. This type is designated by the name of *subintrans* *fever* (*febris intermittens subintrans*), where one paroxysm lasts almost to the commencement of the next one. It is by such a dovetailing of paroxysms, one into the other, that we attain to the conception of what has been called the *inverse type*, in which the hot and sweating stages precede the chills.

What is the cause of this peculiar rhythm of malarial affections? It is impossible to answer this question with certainty. In taking our point of departure from theories actually prevalent, we may suppose that the moment of access coincides with the development of the morbid germ in the organism. The agent of infection having fixed itself in certain parts of the economy, the spleen for instance, there silently accomplishes its evolution; then having attained the phase of its full development and activity, it enters the circulation and determines the paroxysm of fever, by the intermediation of which it is either destroyed, or eliminated, or at least rendered for a time inactive.

As for the general course of the disease, it is to be remarked that in some cases the appearance of the febrile access is preceded by other symptoms of a prodromic order, such as lassitude, irritability of temper, cephalalgia, loss of appetite, furred tongue, sensation of weight in the epigastrium, nausea. At the same time, there is a slight fever without any well-marked chills or subsequent apyrexial period, and one might

be tempted to believe that he had before him a case of gastric fever, or typhoid at its onset. Little by little the characteristics of intermittent fever unfold themselves, the paroxysms being at first of an erratic order, then taking on a regular rhythm. In other cases, the disease begins suddenly, without prodromes, by a well defined paroxysm.

If the proper treatment is not resorted to, and if the patient remains exposed to the influence of malaria, the disease is prolonged indefinitely. The anæmia and cachexia are more and more pronounced, and the spleen acquires an exaggerated volume. When, on the other hand, the ague-patient early removes himself from the area of marsh infection, the disease, as a rule, gets well of itself. The paroxysms are more and more light and lose their regular rhythm; the spleen shrinks back to its natural size. Nevertheless, isolated attacks or in series may from time to time return long afterward.

An appropriate treatment also rapidly arrests the paroxysms in the great majority of cases, but a relapse is always to be dreaded. Such relapse ordinarily comes on about a fortnight after the cessation of the intermittent, and in most cases, on the very day of the week on which the last ague-fit occurred. These relapses are especially to be feared when the patient remains exposed to the malarial emanations, and they are occasioned by the same causes as determine the disease : chilling, errors in diet, etc.

2. The malignant intermittent fevers (*intermittens comitata*) are characterized by the special gravity of the symptoms accompanying the attack. They are also designated under the name of *pernicious intermittent*.

These pernicious fevers are the expression of a malarial infection of uncommon severity, and are oftenest witnessed in countries where malaria rages with great intensity. They may, however, exceptionally occur in localities where the type of the disease is ordinarily benign. Generally the grave symptoms do not appear coincidently with the first ague fit, but manifest themselves by degrees, or quite suddenly, after several paroxysms of a simple character. They may, under certain circumstances, kill the patient in the first attack, but oftener death does not take place till the second or third attack. Moreover, these pernicious fevers present the same rhythm as the simple intermittent, but they are distinguished from the latter by an abnormal ascension of the temperature, and by the longer duration of the hot stage.

In many cases, the perniciousness of the attack consists solely in an aggravation of the ordinary febrile symptoms, and is but the consequence of the abnormal violence and longer duration of the fever.

In the cold stage, the chills may amount to general clonic convulsions, as is especially observed in the case of children. If after the convulsions there is loss of consciousness, the fever is classed as *eclamptic*.

or *epileptic intermittent* (*febris intermittens eclamptica seu epileptica*).

In tetanic intermittent (*intermittens tetanica*) there are tonic convulsions which may go on to opisthotonos and emprostotonos.

In the hot stage, the gravity of the symptoms depends chiefly on the high elevation of the temperature and on the abnormal duration of the fever. The delirium, which is habitually very mild in attacks of simple intermittent, may be extremely violent, and in some cases end in mania. This is called *intermittens delira* (*delirious intermittent*). In another form, the cerebral disturbance is characterized by coma, and under this head may be classed those cases of apparent death which belong to the cerebral form of intermittent (*comatose intermittent, apoplectiform intermittent*).

In all stages, death may supervene by paralysis of the heart: *syncopal intermittent*; it may also be brought about in the cold stage by the excessive contraction of the arteries, and in the hot stage by the hyperthermia.

When, in the first stage, the heart is already notably enfeebled, it may happen that the anæmia and chilliness of the surface will continue even after the internal temperature has attained its maximum and begun to fall. The pulse remains in this case small, filiform, almost imperceptible; this is called *algid intermittent*. In this form the patient may succumb to paralysis of the heart long after the fall of the fever, and during full consciousness.

In the sweating stage, the sweats may be abnormally profuse, and prolonged into the apyretic period; this is designated as *febris perniciosa diaphoretica*. In these cases death may also be the consequence of cardiac asthenia. When the patient does not succumb during the paroxysm, he falls into a typhoid state, with somnolence, stupor, fuliginous coating of the lips and gums, etc., which is the consequence of the hyperthermia.

In other cases, the symptoms which accompany the access are to be considered only as accidental complications. If in an individual who finds himself under the influence of marsh infection, there supervenes another disease: bronchial, or intestinal, catarrh, dysentery, typhoid fever, pneumonia, such disease will assume, in a certain measure, the type of the intermittent fever, and present exacerbations and remissions in its symptoms according to the periodic rhythm of intermittent. It is quite possible by quinine to break up this periodicity and thus dispel the intermittent symptoms, while the original disease pursues its normal course. We shall speak farther on of other complications.

Lastly, there are certain manifestations which can not be regarded as an exaggeration of the ordinary febrile symptoms, or as accidental complications, but which are rather the effects of a localized action of the marsh poison. Thus, there may supervene a profuse serous diarrhoea, with vomiting, precordial distress,

cramps, Hippocratic features, imperceptible pulse, in a word, all the symptoms of cholera: this is the *choleric form* of the malady. At other times, in which also there is a localization of the disease in the intestinal canal, there is a diarrhœa with mucous, bloody discharges, tenesmus, etc.; this dysenteric form is called *febris perniciosa dysenterica*. In still another form there are hemorrhages from the stomach, intestines, bronchi, kidneys, which take place during the paroxysm: (*febris perniciosa hemorrhagica*).

Finally, it sometimes happens that one will observe all the symptoms of an attack of pneumonia, in which the pulmonary exudation augments during the paroxysm, diminishes during the apyrexia, and disappears at the same time as the malarial affection: (*febris perniciosa pneumonica, pneumonia intermittens*.)

Since the discovery of melanæmia and the obstruction of the capillaries by pigment, there is a tendency on the part of pathologists to refer the symptoms of pernicious fever, for the most part, to this anatomical lesion. Nevertheless, if this pathological alteration may in some cases explain certain functional troubles, it cannot be invoked in explanation of even the greater part of the symptoms in question. Many of these symptoms are but a simple exaggeration of the phenomena due to fever, and it is useless to look farther for a cause. Besides, as we have said, many of these functional disturbances manifest themselves at the moment of the access, and disappear with it. It cannot be, then, a question in these cases of an obliteration of the vessels, or of any other persistent anatomical lesion. Lastly, in many cases presenting pernicious manifestations, no traces of melanæmia have been found.

3. *Remittent Fevers*.—Under the name of remittent or pseudo-continued fever is designated a grave form of malaria in which there is no true apyrexial period between the attacks, but only a more or less marked remission. These forms are chiefly observed in countries where intense malaria prevails. By reason of the elevation of the temperature, which constantly keeps above the normal, there is ordinarily quite rapidly developed a typhoid state, with stupor, delirium, somnolence, and a fuliginous state of the lips, tongue and gums. The spleen is always greatly augmented in volume. Icterus is often observed as a complication.

Sometimes there are eschars, pètechiaë, epistaxis, vomiting of blood and hæmaturia. Albuminuria is frequent. The urinary secretion is sometimes diminished, and often suppressed. During the febrile exacerbations, which generally assume the quotidian type, more rarely the tertian, and which are sometimes quite irregular, there may supervene symptoms exactly like those of ordinary pernicious fever. The grave remittent forms often terminate in death. Some cases—and by far the smallest number—may undergo transformation into simple intermittent, and get well. As consecutive affections, may be mentioned dropsies, profound cachexia, chronic engorgement of the spleen and liver, and melanæmia.

In countries where malaria rages with intensity, many physicians are inclined to refer the greater part of febrile mala-

dies to the swamp poison. Thus it is that we often find described as examples of remittent marsh fevers, cases of pneumonia, typhoid fever, yellow fever, pyæmia, etc. The differential diagnosis is, in fact, in some circumstances very difficult, and from this point of view, a great importance should be attached to the march of the temperature, as well as to result of the treatment by quinine.

4. *Masked Ague*.—Masked intermittent consists in neuralgias or other nervous troubles, which present the intermittent type, and appear under the influence of the marsh infection.

The most frequent form is neuralgia of the tri-facial, particularly of the supra-orbital and infra-orbital branches.

Occipital, intercostal, and sciatic neuralgias are more rare. Besides the pain, there exist other symptoms which habitually accompany neuralgias; in facial neuralgia, for instance, fluxes from the nasal mucous membrane and the conjunctiva. The malarial infection may also in certain cases manifest itself by other nervous disorders, such as cardialgia, intestinal colic, obstinate sneezing, cough, paralyses, attacks of vertigo and syncope, etc. The type of malarial neuralgias is generally quotidian, more rarely tertian or quartan. The accession is generally accompanied by a certain elevation of the temperature, or other febrile symptoms.

Veritable outbursts of fever may usher in or follow the neuralgic accessions or alternate with them, so as to constitute a double tertian.

The masked intermittent is relatively rarer than common intermittent, and is observed chiefly in countries where malaria prevails with little intensity.

Sometimes the marsh poison determines other morbid manifestations, which present a certain similarity to masked intermittent, such as catarrh of the nasal mucous membrane or of the bronchi, diarrhœa, cutaneous eruptions such as erythema, erysipelas, urticaria, hemorrhages from the various mucous surfaces, etc. In the diagnosis of these larvated forms, one should have regard especially to the periodicity of the symptoms, to the elevation of the temperature, and lastly to the fact of the patient having been exposed to the malarial infection. Certain of these forms are very rebellious to the action of quinine, and only yield to enormous doses.

5. *Malarial cachexia*.—Malarial cachexia is a consequence of the prolonged or oft repeated action of the poison. In the majority of cases it appears only as a sequel of fevers or other malarial disorders long continued. Sometimes, however, under the influence of a particularly virulent miasm, it may manifest itself at the outset, without having been preceded by any febrile attacks. The patients become anæmic, grow thin, and have an ashen color. The spleen, sometimes also the liver, are notably augmented in volume. In advanced cachexia, there may be melanæmia and amyloid degeneration of the spleen, liver, and kidneys; some patients are affected with chronic intestinal

catarrh, have a tendency to hæmorrhages, become dropsical, and finally die of exhaustion, unless carried off by an intercurrent disease: pneumonia, dysentery, pulmonary phthisis, etc.

COMPLICATIONS AND SECONDARY AFFECTIONS.

An incomplete apyrexia, not frank, and traversed by certain morbid symptoms, is occasionally observed, and is of itself a complication. Very often digestive disorders, sometimes a bronchial catarrh, precede the paroxysm, and manifest an exacerbation at the moment of the outbreak. It is not uncommon to see herpes labialis, which may, under certain circumstances, and notably in the differential diagnosis of typhoid fever from malaria, have a great importance. In certain cases, urticaria and other exanthemata are observed. Icterus, is occasionally witnessed, especially in the grave forms, and seems to depend, not on retention of the bile, but on degeneration of the liver.

As consecutive affections, we must note in the first place the great frequency of chronic engorgement of the spleen, which ordinarily does not provoke any manifest disturbance. Next in the order of frequency come dropsical effusions, which consist sometimes in simple œdema of the extremities, sometimes in general anasarca. Such dropsies may even be the consequence of simple intermittent.

When these dropsical swellings are not dependent on albuminuria, they may rapidly and completely disappear with the attack which they accompany. At

other times they are symptomatic of a grave affection of the kidneys, of chronic parenchymatous nephritis, or of amyloid degeneration of those organs. To the secondary diseases belong also melanæmia and malarial cachexia with all their consequences.

TREATMENT.

Under the head of etiology we have called attention to the two principal *prophylactic measures* which may contribute to the diminution of malaria in a country, such as the sanitary improvement of a district by culture of the soil, drainage, etc. We might mention also the good results obtained in many infected regions (notably in Italy, Spain, Algiers, and Palestine) by plantations of eucalyptus globulus.* In central Europe, where the tree can not grow in the open country, a good substitute may be found in the sun flower (helianthus annuus) which has also given encouraging results from the point of view of prophylaxis.

The hygienic precautions for individuals to take in countries where malaria prevails, consist in preserving one's self as much as possible from the influence of emanations of the soil, which are especially baneful during the evening and night time; in not using for drinking purposes the water of a suspected region till it has been previously boiled; in short in removing one's self from all influences which may determine an outbreak of fever. The use of quinine as a prophylactic is, in many circumstances, especially to be

* Plantations of the eucalyptus tree are anti-malarial, not by virtue of any specific property which they possess, but by reason of excessive absorption of water through their roots. They thus promote dryness of the soil. (Guiraud.)

recommended. In all cases where malaria is prevalent and susceptible individuals are exposed, quinine should be at hand, and employed in large doses coincidentally with the first manifestation of the infection.

TREATMENT OF THE AGUE PAROXYSM.

The fever fit itself, in simple intermittent, demands little medicine. The patient should keep his bed and be allowed hot and cold drinks according to his needs. During the cold stage, the attempt should be made to bring back heat as speedily as possible by bed clothes, hot wrappings and other artificial means. During the sweating stage, on the other hand, the coverings should be light. A very high elevation of temperature, even in ordinary intermittent, does not demand any active interference, because this temperature is certain to come down of itself in a little while.* At the same time, during the period of heat it is quite proper to use refrigerant lotions; the whole body may be sponged with cold water, or ice may be applied to the head. If there are any signs of enfeeblement or failure of the heart, as is observed in feeble individuals or in attacks of great violence, stimulants will be demanded, such as ammonia, musk, ether, and especially alcoholic preparations.

Attempts to abort the access by means of vapor baths, cold douches, blood-letting, emetics, inhalations of ether or

*In these pyrexial accessions, much relief is sometimes experienced from a fifteen grain dose of antipyrine.—TR.

chloroform have sometimes succeeded in preventing the full development of the paroxysm, but no advantage to the patient results from these means, the consecutive apyrexia being neither as frank nor as complete as it otherwise would be.

Quite different is the management of the pernicious forms of intermittent, the first accession of which is attended with great danger, and often, by its long continuance, makes energetic treatment urgent. In all the accessions which are accompanied with pernicious symptoms, the attending physician should administer, during the ague fit, without waiting even for a subsidence of the chill, large doses of quinine, which may be given, if needed, by the rectum, or injected subcutaneously. (See Appendix I.)

Moreover, all the symptomatic manifestations which supervene as complications call for active interference.

As for the treatment of the disease itself, we possess in quinine a specific medicine which can hardly be said ever to fail when the case is not too inveterate. In instances where administered in sufficient doses, and under an appropriate form, quinine fails to relieve or cure, the physician is warranted in believing either that he is mistaken in his diagnosis, or that he has to do with abnormal complications or an intercurrent disease.

The question whether quinine should be immediately administered after the first attack, or if it is better to wait till after a series of attacks, is answered to-day in favor of its immediate administration, for

experience has shown that the longer the disease lasts, the more obstinate and intractable it becomes.

The previous administration of an emetic or purgative, in accordance with a former practice when cinchona bark was given instead of quinine (then undiscovered), is not to be recommended, and whatever utility such preparatory treatment may have had formerly, it is certainly seldom required at the present day.

It does not make any particular difference, as far as the effects of the treatment are concerned, whether the necessary quantity of quinine is given in one dose or in several doses. It is perhaps the better way to give the quinine in fractional doses during the apyrexia. If, as is the custom with some practitioners, the quinine is given in one full dose, several hours before the paroxysm, it may happen that the attack will not be at all modified thereby, and that the effect of the medicine will not be felt until the next attack.

In the simple intermittent fevers of countries where malaria does not prevail with great intensity, one full dose of fifteen grains (1 gramme) given in the interval of the attacks ordinarily suffices to cut short the intermittent. Rebellious fevers, and especially the larvated and pernicious forms, demand larger doses. In the pernicious forms, as much as thirty grains (2 grammes) should be given during the attack, and thirty or even forty-five grains (2 to 3 grammes) per day in the interval between the

attacks. When a grave attack is imminent, a full dose of forty-five grains (3 grammes) should be given at once, or the same quantity in divided doses near together. Quinine in lavements, with the addition of a few drops of laudanum, is a little less active than when given the ordinary way, and the doses must necessarily be larger.

The way in which quinine acts in malarial affections is a problem which as yet is far from being solved. If we take for granted that malaria is a living miasm, the most natural explanation would be that quinine acts as a specific poison to the microbes that cause the disease.

The form under which quinine is administered is not altogether a matter of indifference. In the state of solution, it is more rapidly absorbed than under the form of powder or pills. The chloride (quinine muriate, hydrochlorate) is more active than the sulphate, containing, in equal weights, more quinine. In simple intermittent fevers the following formulæ may be employed:

℞ Quiniæ sulph., gr. xv.
Acid sulph., q. s. to dissolve.
Syrup rubi (vel aurantii cort.). 3 vi.
Aquæ pimentæ, q. s. ut ft., $\frac{3}{4}$ vi.

M. Sig.—A tablespoonful every hour till the whole is taken.

℞ Quiniæ sulph., 0.20 (gr. iii.)
Pulv. aurantii cort., 0.30 (gr. v.)
Sacch. alb., 0.50 (gr. viii.)

M Divide in chart., No. v.

To be taken in the interval of the attacks.

R Quiniae sulph., 1.20 (℥i.)

Ext. gentian, q. s.

F. S. A. pil. No. xx. (which may be rolled in canella powder).

Dose.—Two pills every hour or every second hour.

In the case of children, the dose should be proportioned to the age. The alkaloid may be replaced by cinchona bark, one of the best preparations of which is the acidulated decoction, which contains all the active principles of Peruvian bark.

Take of bruised calisaya bark, 30 (℥i.)

Boiling water, 150 (f℥v.)

Dilute hydrochloric acid, 5 (℥i.)

Mix, macerate over night. Add distilled water, and boil down to 250 grammes (℥viii), then add:

Spts. eth. nit., 4 grammes (℥i.)

Syrupcanella (vel aurantii cort.), 30 grms. (℥i.)

Dose.—A tablespoonful every 2 hours.

The effects of cinchonidia are less certain than those of quinine, hence the dose must be large. Amorphous quinoidine should be reserved for mild forms when small doses suffice, for large doses often cause vomiting.

The high price of quinine has led physicians to look for substitutes, and most of the vegetable bitters have been used with this end, though with indifferent success. Among the most efficacious are berberine, buxine, piperine, salicine, laurel leaves, etc. The leaves of blessed thistle have also been used, marsh-trefoil, gentian root, sweet flag root, wormwood, etc. Powerful emetics, the contra-stimulant medication, even strong moral emotions have sometimes had the effect to abort an expected attack, or make it milder, and even modify the rhythm of succeeding attacks.

Salicylic acid succeeds in some cases in cutting short the fever; in others the effects are nil. The preparations of eucalyptus globulus, notably eucalyptol, have an incontestable action, but much less certain than that of quinine (vide appendix 6.)

A medicine of great efficacy in malarial affections is arsenious acid, but the effects do not generally manifest themselves till after prolonged use of the remedy—several days or even several weeks. In inveterate cases, when quinine has exhausted its action, beneficial results have been obtained from this medicament. The form of arsenic which is generally administered is Fowler's solution, of which from 3 to 6 drops may be given three times a day after meals. [Another popular form of arsenic is the Asiatic pill, which arsenious acid is combined with black pepper. Pills are made by American pharmacists containing from $\frac{1}{100}$ to $\frac{1}{80}$ gr. of arsenious acid and constitute eligible preparations.]

After the cessation of the attacks, it is necessary to prescribe a fortifying treatment in order to prevent the relapses to which malarial patients are subject, even after their removal from the malarial district; relapses which are to be expected as long as the hypertrophy of the spleen remains. To attain this object, small doses of quinine must be given for a long time. The doses should be proportioned to the gravity of the infection, (from 3 to 15 grains a day). Quinoidine may be given instead of quinine in pills or tincture,

and the patient should be carefully watched to see that there are no incomplete ague fits, for it is in this way that relapses often begin; a full dose of quinine given at a seasonable time always succeeds in preventing the relapse.

For the chronic engorgement of the spleen, the cachexia, and most of the consecutive diseases, the prolonged usage of quinine is the most efficacious treatment.

The decoction of cinchona bark, acidulated with hydrochloric or sulphuric acid, may also be employed. To bring back the spleen to its normal size, preparations of iodine, cold douches, and strong induction currents are often useful.

Ferruginous preparations also often produce good results. Finally, in inveterate cases especially it is important to associate with the specific treatment and that of the complications, all measures, which may improve the general state of nutrition.

APPENDICES BY TRANSLATOR.

1. *The administration of Quinine in Intermittent Fever. Are the Physiological Action and the Therapeutic Action Coincident ?**—All physicians are agreed as to the utility of quinine in intermittent fevers, and whatever scepticism may exist with regard to the usefulness of medicines in general, no one doubts that the alkaloids of cinchona are efficacious in malarial diseases. Nor is there much difference of opinion as to the dose required.

*Reprint from the Boston Medical and Surgical Journal, April 21, 1887.

There is not the same unanimity as to the period when sulphate of quinine should be given in order that the utmost benefit may be derived from it. Junior practitioners are apt to experience some bewilderment on finding that for a long time three great methods of administering bark (or quinine) have prevailed; all differing somewhat in details. There is, first, the method of Torti, called the Roman method, then that of Sydenham, called the English method, and finally that of Bretonneau, called the French method. Torti gave his cinchona bark (quinine was then unknown) immediately before the ague fit. He prescribed two or three drachms of the powder in one dose, then he let the patient rest two days, then give for two days in succession one drachm, and after an interval of a week, half a drachm every day for a week. Sydenham administered one large dose (3 iii.) of bark (which he called "febrifuge powder") after the paroxysm, and repeated the same dose every four hours, till the time of the next chill, then let the patient rest a week, when he recommenced the treatment. Bretonneau and Trousseau, who lived after the discovery of quinine, began the treatment with one large dose of sulphate of quinine, which they gave immediately after the attack; this is also Briquet's method, who urged that at least fifteen hours should elapse between the giving of the dose and the ague fit which he wished to prevent. This is also the practice of Jousset, the leader of Homœopathy in France.

Dujardin-Beaumetz, in commenting on the views of these French authorities, thinks that the space of time which separates the administration of the massive doses from the onset of the chill is too long, the physiological effect will have worn off; and he recommends to give the quinine, not immediately after the ague fit, but three or four hours before. When the fever is tertian (which is the most frequent type) he would give the quinine every other day, in one dose of half a gramme to a gramme—enough in fact should be administered to pre-

vent the expected attack. This was also substantially the method of Gubler, who gave his quinine five or six hours before the time for the chill, as it takes about that time for the physiological action of the alkaloid to attain its maximum.* Sometimes he would begin the treatment the night before the looked-for return of the chill (the patient being allowed exemption from medicine on apyretic days); at bedtime he would give the patient twenty-five centigrammes in one dose, and follow it by another equal dose in an hour; the next morning another twenty-five centigramme dose would be administered, and with this entire quantity of seventy-five centigrammes, thus given in anticipation of an attack, he was generally successful in throttling the malady.

Torti, Sydenham, Bretonneau, Trousseau, and Briquet, agree in this, that the massive doses of quinine should be given a long time (at least fifteen hours) before the ague fit which they desire to prevent. Gubler and Dujardin-Beaumetz, believing that the physiological and therapeutical effects are the same, lasting at the most not more than six hours, do not rely on one large dose administered fifteen hours or so before the chill, but prescribe several repeated doses, of a fraction of a gramme, begun near the time of the anticipated febrile crisis.†

We may remark, in concluding, that American practitioners have generally adopted the method of Bretonneau, Briquet, and others, whose experience has taught them that quinine proves most effective when given as near as possible to the paroxysm which has passed. Flint thinks that if the antiperiodic be given in the sweating stage, the chances of preventing the next paroxysm are greater than if the ad-

* Gubler, *Leçons de Thérapeutique*, 1880, p. 374; D.-Beaumetz, *Clinical Therapeutics*, p. 447; Briquet, *Traité Thérapeutique du Cinchona*, etc., p. 500.

† Gubler. *Loc. cit.* p. 373; Dujardin-Beaumetz. *Loc. cit.*

ministration be delayed till after this stage. As regards doses, he says, the most effective plan is to give the remedy so as to produce evidence of cinchonism as speedily as possible. One full dose of ten to twenty grains will generally accomplish this; he prefers, however, the method of giving smaller doses—five grains to an adult, every two hours until cinchonism is produced. By this method of treatment, he affirms, in a case of quotidian type, the chances that another will not occur preponderate.*

Bemiss† follows substantially the same line of treatment. Beginning with the sweating stage, he gives three grains of quinia every hour till eighteen grains have been taken.

Stillé endorses the same method, and remarks that "the anti-febrile influence of quinia does not coincide with its physiological operations, either in time or in degree." The physiological "cinchonism," for instance, will often have passed off, when the therapeutical effects are most apparent. He considers as sufficiently disproved the theory that the antiperiodic action of quinine is due to its sedative influence upon the nervous system.‡

2. WARBURG'S TINCTURE.

This is a popular ague remedy, much used in the United States. Its formula (which is very complicated) was long a secret, and the proprietor is said to have made an immense fortune out of the sale of this remedy, which, till recently, has belonged to the category of "quack medicines."

The formula is as follows:

℞ Aloes Socotrinæ, r℞.
Radiciſ rhei Indici,
Semin. angelicæ,

* Flint's Practice. Third Edition, p. 862.

† Pepper's American System of Medicine, Vol. I.

‡ Stillé. Therapeutics and Materia Medica, Vol. I, page 460.

Confect. damocratis, ℞ 4 oz.
Radic. inulæ,
Croci sativi,
Semin. fœniculi,
Cretæ præparatæ, ℞ 2 oz.
Radic. gentianæ,
Radic. zedoariæ,
Piperis cubebæ,
Myrrhæ electæ,
Camphoræ,
Boleti laricis, ℞ 1 oz.

The above ingredients to be digested with five hundred ounces of proof spirit, in a water-bath, for twelve hours; then expressed and ten ounces of disulphate of quinia added; the mixture to be replaced in the water-bath till all quinia is dissolved. The liquor, when cool, is to be filtered, and is then fit for use.

The rules for the use of the remedy as given by Dr. McLean, of Netly, England, in the Lancet of Nov. 13th, 1875, are as follows: "One-half ounce is given alone without dilution, after the bowels have been evacuated by any convenient purgative, all drinks being withheld; in three hours, another half-ounce is administered in the same way. Soon afterwards, particularly in hot climates, profuse but seldom exhausting perspiration is produced. This has a strong aromatic odor, which I have often detected about the patient and his room on the following day. With this there is a rapid decline of temperature, immediate abatement of frontal headache—in a word, complete defervescence, and it seldom happens that a second bottle is required. If so, the dose must be repeated as above. In very adynamous cases, if the sweating threatens to prove exhausting, nourishment, in the shape of beef-tea, with the addition of Liebig's extract, and some wine or brandy of good quality, may be required."

3. THE USE OF PURGATIVES IN MALARIAL FEVERS

The use of purgatives as a routine method of treatment in simple intermittent, or even in pernicious fevers is not to be commended. Nevertheless, where the attack is attended with a deranged state of the primæ viæ, with furred tongue, foul stomach, hepatic congestion and constipation, the utility of a purgative, and even sometimes of an emetic of ipecacuanha, is unquestioned. A full dose of sulphate of magnesium or sodium, a seidlitz powder, a five grain dose of calomel, is attended with prompt benefit, clearing the alimentary canal of effete matters and toxic ptomaines, and preparing it for the absorption of the quinine.

If mercurials are of especial value in acute cases, rhubarb and especially aloes are applicable to chronic forms of malaria. In remittent and pernicious fevers the digestive and biliary systems are particularly liable to embarrassment; there is a jaundiced skin and furred tongue, the bowels are costive, the urine is scanty and loaded with lithates, and it may be with bile pigment. Here the indications for depurative treatment are clear, and while we give the quinine with unstinted hand, we also find the mercurial or saline purge essential.

4. ERGOTIN IN SPLENIC ENLARGEMENT.

The following is a brief extract of an article by

Winogardo.* He treated two cases of chronic malarial enlargement of the spleen by ergotin in doses of from three to twelve centigrams ($\frac{1}{2}$ gr. to 2 grs.) three times a day. In one case the diminution in size of the spleen was rapid, so that the change could be distinctly noticed from day to day. In the other case the change was not so marked, but Winogardo believed that this was caused by the disease having progressed too far; possibly there was amyloid degeneration or interstitial hypertrophy.

Another Russian physician, Dowodschikow, reports a case of "ague cake" treated by ergot with remarkable results.

Dr. S. W. Caldwell, of Trenton, Tennessee, also claims success with liquid ergot (liquor ergotæ purificatus) in enlarged spleen. His manner of using it is by subcutaneous injections, 30 minims being injected twice or three times a week over the spleen.

5. ANTIPYRIN IN PERNICIOUS MALARIA.

Dr. J. H. Potter writes to the Lancet for April 10th, 1886, that he has obtained satisfactory results in the treatment of severe forms of malarial fever by the administration of large and repeated doses of antipyrin. He says that particularly in cases of remittent type which are not amenable to ordinary treatment,

* Therapeutic Gazette, 1883, page 291. Also volume for 1884, p. 68.

whether by quinine, arsenic, or diaphoretics with aconite, the administration of antipyrin has produced an instant cure in cases which for weeks had been quite unaffected by the ordinary remedies. He is of opinion that in pernicious forms of uncomplicated malarial fever we have in antipyrin a most valuable aid to treatment.*

6. OIL OF EUCALYPTUS IN MALARIAL AFFECTIONS.

The following conclusions embody the results of some studies recently made by Dr. John H. Musser, and reported to the Philadelphia Co. Medical Society, May 24th, 1886:

1. That the oil of eucalyptus is of decided value in about 33 $\frac{1}{3}$ per cent. of all cases of intermitting malarial fever.
2. That it has no specific action in any one type of the disease.
3. That the longer the duration of the disease, the less likely it is to do good.
4. That relapses are not prevented by it.
5. That its influence on the spleen has not been demonstrated.
6. That a dose of ten drops five times daily has been a sufficient dose, but that five drops every three hours would be of greater value possibly.
7. That good results are not attained as quickly

* Therapeutic Gazette, 1886, p. 306.

as with large doses of quinine, but that a good effect should be observed within five days at least.

CHAPTER II.

MIASMATIC-CONTAGIOUS DISEASES.

We designate by the name miasmatic-contagious affections, such infectious diseases as are not, properly speaking, really contagious, being not directly communicable from individual to individual; nor, on the other hand, are they simply miasmatic affections, as the infectious agent, from the point of view of its existence and evolution, is in a measure dependent on man or some higher animal, and in order to accomplish its complete development, must for a time live a parasitic life in the body of some warm-blooded animal.

These diseases are *miasmatic* in the sense that the pathogenic agent capable of causing infection does not come directly from another individual. They are also *contagious* in this respect, that the same pathogenic agent, in the last analysis, is found to derive its origin from an infected individual.

I have endeavored in another place to explain this peculiarity proper to these miasmatic-contagious diseases, by supposing that the micro-organisms which are the cause of these affections, in order to accomplish their normal evolution have to pass through two stages of development, the one outside, the other within the human or animal body. This hypothesis, to which we are led by the observation of

facts, is not at variance with what we know concerning the physiology of the micro-organisms, and is explicable by the supposition of a sort of alternate generation or that of the existence of two modes of reproduction, the ordinary cells of propagation (*conidia*), and true spores (*dauersporen*).

The time during which miasmatic-contagious agents may preserve their vitality outside of the organism varies greatly according to the diseases. The microbe of Asiatic cholera has but a very brief existence in our country. When, in a given locality, no new case makes its appearance at the end of several weeks, one may consider the epidemic at an end; and there is no further outbreak unless a new importation of the germ takes place.

The microbes of dysentery and of typhoid fever, on the contrary, may keep their vitality for several months, and even for years. Dysentery, which may have disappeared during the winter in a given locality, may reappear at the end of the following summer, and without the necessity of a new importation of the germ; and typhoid fever often manifests itself in a neighborhood several years after the prevalence of an epidemic in that region.

What diseases are we to include among the miasmatic-contagious diseases in the sense in which we understand the word? How far are we to extend their domain? This is a question which we cannot yet answer with certainty. Asiatic cholera, dysentery

and typhoid fever belong incontestibly to this group. With regard to each of these diseases, there is not yet perfect agreement as to whether they are contagious or not. While some, basing themselves on numerous observations, are firmly persuaded of their contagiousness, others, from facts no less numerous and no less carefully noted, find grave reasons for doubting the communicability of these diseases. And in fact, as long as our nosology took cognizance of only these two groups, miasmatic and contagious affections, it was not possible to class the above mentioned diseases in either the one or the other category.

In establishing a third group, that of miasmatic-contagious diseases, taken in the sense in which we understand it, we fill the nosological gap. Yellow fever and the plague, two diseases concerning which we find the same want of agreement among observers, ought also, according to what we know of their mode of propagation, to be ranked without hesitation in this group.

As for epidemic meningitis, our knowledge respecting its causation is still too incomplete to assign to this disease a definite place. I have classed it provisionally among the miasmatic-contagious diseases, which it seems to resemble in all its leading features. This disease is still more properly treated under the head of diseases of the nervous system; nor can we in this volume take up but one of the miasmatic-contagious affections, viz: typhoid fever.

TYPHOID FEVER.

Typhoid fever (also called abdominal typhus) is an infectious disease, characterized on the one hand by a continued fever of several weeks duration, and on the other, by certain special anatomical alterations of the lymphatic apparatus of the digestive organs. The constant lesions have their seat in the closed follicles of the intestine, and especially in Peyer's patches, in the mesenteric glands, and in the spleen.

The fever in abdominal typhus is not, like that of dysentery, a secondary fever, dependent on the anatomical lesions; it is primary, and exists before any localization of the disease, and ought to be considered as a direct consequence of the infection. The anatomical alterations do not, then, constitute the whole disease. Typhoid fever is not a local infectious disease, like cholera and dysentery.* On the contrary the

*[In cholera the specific agent acts directly and exclusively on the intestine, and there determines a violent catarrh of the mucosa, with abundant watery transudation. The principal symptoms are but the consequence of this lesion of the intestine, and there is no occasion to admit a direct action of the virus on other organs.]

In dysentery, the infection manifests itself by an inflammation of the mucosa of the large intestine, an inflammation of a diphtheritic nature, and to this intestinal lesion are to be referred all the principal symptoms. In this respect, dysentery bears a marked resemblance to cholera.

The above is the teaching of the author, and of leading German pathologists.]

morbid poison from the very first exerts its action on the entire economy. Typhoid fever, then, like malaria and many other infectious diseases, is a general disease.

The term typhus (*τυφός*, *vapors*, a *fog*) was employed in former ages to designate all febrile maladies the dominant symptom of which was an enfeeblement of the intellectual faculties, *i. e.* *hebetude*, *stupor*. It is in this symptomatic sense, that we still understand that particular state which is called *typhoid*. The divers maladies which are designated under the name of *typhus* have really nothing else in common. Typhus abdominalis is a specific infectious disease, which has no relationship with typhus exanthematicus, and whose symptoms have but a very superficial resemblance to those of this latter affection.

Typhus abdominalis seems to have been from the earliest times one of the most frequent of febrile diseases, but it was designated under very different names: *phrenitis*, *continued fever*, *febris ardens*, *nervosa*, *putrida*, *etc.* The term *hemitriticus* seems to have been at a still later day the term which was most generally applied to this fever.

In the first half of the present century, the grave cases received the name of *nervous fever*, the lighter ones *mucous* or *gastric fever*. The names of *intestinal typhus*, of *ileo-typhus*, and of *typhoid fever* now in use chiefly in England, France and America, are denominations of quite recent origin.

ETIOLOGY.

The etiology of abdominal typhus presents in many respects a great similarity to that of cholera and dysentery. All observations agree in proving that the disease never occurs spontaneously, and that in order

for it to undergo development in a given locality, it is essential that the germ shall exist there already, or be in some way introduced there.

On the other hand, it is very certain that the disease is never directly transmitted from individual to individual. Abdominal typhus is, then, a miasmatic-contagious affection, due to the introduction into the economy of a specific poison from the outer world, which poison primarily originated in a person affected with the same disease.

Starting from the hypothesis that the specific poison of abdominal typhus is a living organism (*contagium vivum*), I have for many years labored, in accordance with an overwhelming amount of constantly accumulating evidence, to bring into harmony, as explicable by this theory, the widely divergent notions heretofore held as to the etiology of typhoid.*

The results thus far obtained have only served to confirm my view of causation. The researches of the last few years, in particular, have demonstrated with almost absolute certainty that the specific agent of typhoid fever is a micro-organism.

The microbiotic theories which are every day winning converts, have led numerous observers to search for the microbes which have a causal relation, to the disease, and these have been sought both in the discharges and in the intestines and other diseased organs of the patient. Among the schizomycetes which have been found, it is highly probable that the bacilli described by Eberth and Koch are the specific agents of the disease, for they have been constantly discovered in the dejections and in the bodies of persons who have succumbed

* See my paper on the Etiology of Abdominal Typhus in *Deutsch Klinik*, 1886, No. 6.

to typhoid fever, and they have not been found in other diseases.*

The bacilli of abdominal typhus, according to the description of Gaffky, are three times as long as they are wide, and they are rounded at their extremities. In length they are about $\frac{1}{3}$ the diameter of a red blood globule. These bacilli are united in groups, form irregularly shaped masses, and are crenated by reason of the projection of some of them, a peculiarity which makes them easy of recognition. These micro-organisms have their foci in the small intestine, and more especially in the closed follicles of Lieberkuhn, and, at a later date, in the mesenteric glands and in the spleen. They have also been discovered in the liver and in the kidneys, where they have been seen in the interior of the capillaries, sometimes completely obliterating the lumen of the finer vessels.

In some cases a spore formation has been observed in these bacilli, and these spores have been found in the internal organs.

Pure cultures may be obtained with the bacilli from the spleen or liver of infected bodies, but unfortunately, all attempts to cultivate such as have been found in the blood have failed,

These cultures, which may be followed for several generations, succeed the best in peptone gelatine, but they also do well on slices of boiled potato.

In these cultures, the formation of spores takes place at the end of three or four days at a temperature of 30° to 42° C., but in a much longer period, and much more incompletely, at

*Vide, C. J. Eberth, On Typhus Bacillus and Intestinal Infection. *Sammlung Klinischer Vorträge*, No. 226. Leipzig, 1883. R. Koch, Zur Untersuchung von pathogenen Organismen. *Mittheilungen aus dem K. Gesundheitsamte*, vol. 1, Berlin, 1881, p. 45. Gaffky, Zur Aetiologie des Abdominaltyphus, *ibid.*, vol. 11, 1884, p. 372.

a temperature of 20° C. At a still lower temperature, the spore formation does not take place. The bacilli obtained in cultures and placed in distilled water have movements of their own which are very marked.

The numerous attempts which have been made to induce the disease in animals (monkeys, hares, guinea-pigs and calves) by the inoculation of these cultures have failed. Nor has better success been obtained with the dejections of typhoid patients, and it is very doubtful whether the lower animals are susceptible of contracting abdominal typhus.

It is by the dejections of patients that the specific germ of the disease is ordinarily propagated. After these dejecta have been voided, the infectious elements which they contain undergo a subsequent and more complete development, and become fit for transmitting the disease to other persons.

The transmission may be effected by the linen and bed clothes which have been soiled by the dejections; but it is chiefly when these have been thrown into cess-pools and privies, or are buried in the ground, that the germ undergoes multiplication. Thus foci of infection are formed, from which miasmatic emanations are disseminated into the surrounding air or are mixed with the drinking water, in cases where there exists a communication between the centre of infection and wells or other water sources. A single patient affected with typhoid fever coming into a neighborhood where the disease does not prevail, may create there a focus of infection from which an epidemic may spread.

The specific agent seems able under favorable

circumstances to live a long time outside of the body. Cases of typhoid fever have been observed to break out in the neighborhood of an old focus of infection, years after the disease had ceased to prevail in that locality.

The principal channels of infection are the air and water. The *materies morbi* may also be introduced into the economy along with the food that is eaten. Infection by the air seems to be the ordinary mode of conveyance. The disease is especially likely to be contracted in the neighborhood of infected centres, where numerous germs in suspension in the atmosphere may be inhaled with every breath.

The propagation of the infection by the drinking water is also demonstrated by facts abundant and conclusive, and is indeed generally admitted at the present day. The pathogenic agent may find its way into the water of a well or spring by filtering through the soil intervening between that water source and a cess pool, privy or dung-heap which has been contaminated with the germs of typhoid fever, as has happened in numerous instances.

The water of aqueducts is sometimes contaminated in the same way, and this mode of infection has been the cause of extensive epidemics.* I need

* [See the accounts of the epidemics which prevailed in Lausen, as given in the author's article on typhoid fever in Ziemssen's *Cyclopædia*. In this case the aqueduct water had become contaminated.]

hardly remark that the excrementitious matters normally found in cesspools and privies are relatively inoffensive, and that it is only in cases where these matters contain the specific germ that their admixture with the drinking water may give rise to abdominal typhus.

The typhoid germ, inhaled with the air of respiration, is arrested by the epithelium of the fauces and pharynx, and by deglutition finds its way into the intestinal canal, where it determines its specific lesions. The disease seems to locate itself primarily in the inferior portion of the small intestine. There it fixes itself, and multiplies in the closed follicles, especially in Peyer's patches, and their vicinity. The mesenteric glands are then attacked, the poison penetrates the blood, and finds a lodgment and a nidus for multiplication in the spleen and often in other organs.

The development of an epidemic in a region where there has been an importation of germs by a sick person, depends on a multitude of circumstances of considerable complexity. In general, the fitness of a locality to be a disease focus and the probability of an epidemic spreading therefrom, largely depend on the opportunities which the inhabitants may have of breathing or absorbing through drinking water the specific principle in the shape of particles of organic matter contaminated by the dejections of patients.

Every accumulation of excrementitious matters increases the aptitude of a locality to be a nidus of the

disease. Hence it is that in a great many English cities, the frequency of typhoid fever has been very much lessened by the adoption of efficient sewerage systems.

As for meteorological conditions the influence of seasons is predominant, summer weather favoring and winter retarding the development of typhoid germs. Hence, in most countries, the maximum of frequency of abdominal typhus is at the end of the summer and in the fall, particularly in August and September, and the minimum is between February and April.

In the southern hemisphere, the maximum intensity of typhoid fever naturally occurs in months when the disease may be said to be the least prevalent in our hemisphere. Thus, in Melbourne, Australia, the maximum falls in May, the minimum in October. Munich escapes the action of the law stated above, the maximum of deaths from typhoid occurring in February (Pettenkofer, Wagus).

The manifest influence of oscillations in the level of the subterranean water bed on the frequency of typhoid fever has been remarked in Munich, though the relationship has not been so well determined elsewhere. When there is a rising of the water level, the number of cases of typhoid diminishes. When the water level sinks, cases are on the increase, and epidemics prevail. (Buhl, 1865, Pettenkofer and Wagus).

It is true, as above stated, that this intimate relationship has not been so well demonstrated in other places, nevertheless there are localities besides Munich where a certain influence of oscillations in the subter-

anean water level on the frequency of typhoid has been recognized, and it was long since remarked by good observers that abdominal typhus is much more likely to prevail after a dry, hot summer, than after a cold and rainy season.

To explain this influence of the subterranean water bed, some have thought that when the water level sinks, the air has access to layers of earth impregnated with organic matters still moist, and hence capable of undergoing fermentative changes (Buhl and Pettenkofer). The lower the water is, the greater must be the quantity of organic particles in suspension in it, and the more likely the latter are to contaminate the wells of drinking water.*

From the point of view of individual receptivity, age plays an important part. It is between the ages of fifteen and thirty that the disease is much the most frequent. Children are far less likely to contract the disease than adults, and after middle life, individual predisposition decreases considerably with age.

The male sex pays a larger tribute to the disease than the female.

As a general thing, typhoid fever attacks in preference persons naturally healthy and vigorous, sparing those that are debilitated by sickness or other cause; this is the opposite of what happens during cholera epidemics. Pregnancy and the puerperal state diminish the predisposition.

A first attack of the disease confers a certain immunity, less absolute, however, than in the case of small-pox, measles and scarlet fever.

* Zur Aetiologie des Abdominal typhus (Deutsche Klinik, 1866, No. 6).

Persons who reside a long time in a locality where typhoid fever is endemic are much less likely to take the disease than new-comers.

Influences which were formerly supposed to play a part in the etiology of typhoid—then called nervous fever, such as moral emotions, fear, sorrow and care, cannot be considered determining causes, any more than can over-work, catching cold, errors in diet, etc. All these influences, however, have some importance as predisposing causes, increasing the receptivity and preparing the soil on which the infection lights.

The duration of the incubation stage of typhoid fever is from two to three weeks. In some rare cases it may be even shorter, in others longer, amounting to four weeks.

Symptomatology.

We will begin by describing the normal typical form of abdominal typhus.

STADIUM PRODROMORUM.—The disease is preceded by a prodromic period, which is ordinarily longer than that of other acute affections. This period is characterized by general malaise, lassitude, loss of appetite, abdominal pains and diarrhoea. These prodromes generally last from five to ten days, although in rare cases they may continue a fortnight. This period is seldom shorter than five days, or wanting altogether.

The transition from this prodromic stage to that

of the regular disease takes place gradually, and is announced by the appearance of fever.

PERIOD OF THE REGULAR DISEASE.—The course of the fever is quite peculiar. It is easy to distinguish four periods, each lasting about a week, and each characterized by a somewhat different march of the fever.

In the first week, there is a gradual elevation of the temperature, with persistence of the normal daily oscillations. Every evening the temperature is higher than the previous morning, and there is a slight fall the next morning. In the second half of this week, the fever of the evening often mounts up to 40° C. (104° F.), and sometimes even attains a higher figure.

In the second week, the fever is continuous, and the temperature remains at the maximum, or even occasionally rises above it. In the evening it is above 40° C., and in the morning a little below. In grave cases, this daily oscillation is much more marked than when the type of the fever continues mild.

In the third week, the temperature is still as high the first few days, but the morning remissions become more marked, and the fever which previously was continuous, now changes to sub-continuous or remittent.

In the fourth week, the fever becomes frankly intermittent. The morning remissions are much greater, and the evening exacerbations lower; you note now on the schematic representation the long descending

oscillations—it is the *peaked thermometrical curve*,
(*steilen tagescurven*).

With the rise of the temperature, appear now the symptoms which are the habitual consequence of the hyperthermia: the higher the thermal elevation and the longer it lasts, the more pronounced are these symptoms; the frequency of the pulse is ordinarily in the ratio of the febrile rise, nevertheless this is a less constant feature of typhoid fever, given a certain elevation of the temperature, than of most other febrile diseases, as long as there is no enfeeblement of the heart. When the heart contracts with force, the pulse does not ordinarily rise above 110, and in many cases does not exceed 100 during the entire continuance of the disease.

There are various circumstances which have a considerable influence on the frequency of the pulse. Thus it is that the patient has only to change the recumbent for the sitting posture to cause the pulse to mount up to 120 and even higher. But what contributes most certainly to augment the frequency of the pulse, is the enfeeblement of the heart in consequence of the long duration of the fever. When, for instance in a patient during the period of febrile rise (*stadium incrementi*), the pulse without any perceptible cause ascends to 120, and keeps at that figure a certain time, the medical attendant should consider this sign as of decidedly unfavorable import.

As for the quality of the pulse, it is soft, com-

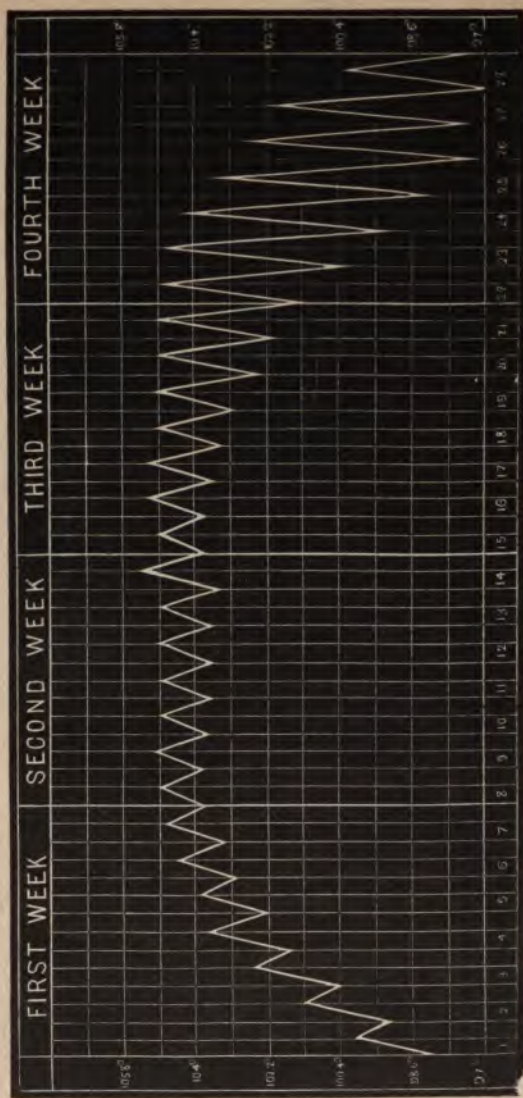


FIG. 3.

SCHEMATIC REPRESENTATION OF THE FEVER IN ABDOMINAL TYPHUS.

pressible, and gives the sensation of an artery almost empty. When the fever has lasted several days, a marked dirotism of the pulse manifests itself; this is perceptible even to the untrained fingers. As long as the heart contracts with sufficient energy, the artery is powerfully lifted by the blood wave. The weaker the heart becomes, the smaller, feebler and more compressible is the pulse.

We must regard as secondary effects of the elevation of the temperature, the functional disturbances of the nervous centres which have given to the disease the name of typhus. That these nervous troubles are due principally to the hyperthermia, is clearly shown by the fact the antipyretic treatment prevents the appearance of these typhoid symptoms, or causes their disappearance if they are already present.*

*Medical readers are familiar with the preponderant rôle assigned by Liebermeister and his school to hyperthermia in the production of the so-called typhoid accidents and degenerative lesions observed in typhoid fever and in some other infectious diseases. This influence may seem to be a little overstated, and that of the general poisoning of the economy a little too much relegated to the second rank, if we take in consideration the fact that certain infectious diseases in which the fever is generally very moderate, diphtheria for instance, present the same alterations. Vallin has, moreover, related a case which is very instructive from this point of view. He found an extensive vitreous degeneration of the muscles of the abdomen and thigh, such as is found in cases of grave typhoid, in an individual who had succumbed to typhoid fever of the

The spontaneous fall of the fever in the third or fourth week generally brings with it the rapid disappearance of the psychical disorders. Nevertheless, in some instances it takes a long time for the mental faculties to be completely restored, a fact which is easy to understand, if you take into consideration that the persistence of an abnormal temperature must have caused material alterations in the nerve centres.

As we have just stated, we regard the cerebral symptoms, as a consequence of the high elevation of the temperature. We should, however, make certain exceptions to this general statement. The typhoid infection itself may directly (or at least without any preternatural elevation of the temperature being necessary), determine certain sensorial and psychical disturbances. Among those functional troubles which do not depend directly on the hyperthermia, should be mentioned especially certain symptoms which are apparent in the prodromic period, as also in the milder forms of the fever without hyperpyrexia, such as the general malaise, the lassitude, the intellectual torpor, the unfitness for mental or physical labor, also the headache, the vertigo, etc.

apyretic form, and whose temperature had never exceeded 38° C.

Moreover, Strube observed in 1870 an epidemic of typhoid fever in which cerebral symptoms predominated, and where the temperature in almost all the cases remained below the normal during the entire duration of the disease. (Note by Guiraud).

In order to give a better representation of the disease in its symptomatic aggregate, we will take a grave case which goes on without complications to a favorable termination, and is treated by the expectant method. With the antipyretic treatment applied as is the custom at the present day, the course of the disease is in fact notably mitigated.*

In the first week, during the period of febrile increase (*stadium incrementi*), with evening exacerbations and morning remissions, the symptoms which the fever constantly brings in its train become more and more marked.

The patient experiences a painful sensation of heat, interrupted by occasional chills, particularly in the afternoon. The skin is dry, hot, and red. There is complete anorexia, a burning thirst, a feeling of lassitude and prostration; the sleep is restless and disturbed by continual dreams; in the daytime the patient lies in a state of somnolence, and is at times a little delirious. The headache increases at first, then ceases about the end of the week.

The tongue at the onset is still moist, somewhat swollen, sometimes covered with a thick fur. Later, it tends to become dry, contracted, and pointed, is fiery red, and is tremulous when protruded.

Towards the end of the first week, the abdominal symptoms also attain full development. The abdomen

*The advocates of the antipyretic treatment do not claim that the disease is cut short thereby.—TRANS.

is slightly tympanitic, somewhat painful over the ileo-cæcal region, where deep pressure elicits gurgling. In most cases the stools are diarrhœic.

About the end of this week, the spleen is found by percussion and palpation to be augmented in volume. Sometimes also the rose spots begin to be seen, while at the same time appear the signs of catarrh of the small bronchi, having its seat principally in the inferior part of the lungs.

In the second week, while the fever still remains continuous at about the same degree, the skin is hot and dry (*calor mordax*), and the face is red and sometimes livid.

The bodily temperature continuing at the same height, the typhoid symptoms become more and more marked; the patient lies in a state of stupor, and somnolence, seldom experiencing true sleep, the subject of a tranquil delirium in which he mutters incoherent words (*febris nervosa, stupida seu torpida*). He makes unconscious movements with his fingers, and picks at his bed-clothes (*carphologia*). Those muscular twitchings known as *subsultus tendinum* are observed. More rarely there is furious delirium with illusions and hallucinations; the patient speaks with a loud voice, makes violent gesticulations, leaps out of his bed, and performs actions of the most disordered kind.

The tongue is dry, cracked, and covered with

black sordes, and the same is true of the gums and lips.

The urine and alvine evacuations are passed involuntarily in bed. The meteorism, the sensibility of the ileo-cæcal region, and the gurgling are more and more pronounced.

In most cases there is diarrhœa with four or five evacuations and even more, in the course of the twenty-four hours. These evacuations are serous and of a color varying from yellow to pale brown (pea soup stools). After standing, they separate into two layers, an upper layer formed of a turbid, slightly brownish liquid, and the lower of a soft yellowish mass, possessing little coherence and flocculent. The reaction of the liquid is alkaline, and it contains a little albumen. In the sediment there are also found debris of food, detritus of all kinds, schizomycetes and well-formed crystals of triple phosphate.

The urine often contains a little albumen. The spleen still continues to increase in size, but by reason of the meteorism, it is difficult to determine its limits by percussion.

The roseola generally makes its appearance in the first half of the second week, in the form of little isolated spots of a pale red color, which disappear under pressure of the finger. The eruption generally has its seat in the lower part of the thorax and upper abdomen, and thence extends sometimes to other parts of the body. In mild cases, the rose spots are

wanting; in well marked cases they are constant, or nearly so. Sometimes few and discrete; sometimes numerous and of large size, they are generally of bright color, and may be scattered over the entire body.

On examination of the thoracic organs, we constantly detect the signs of catarrh of the small bronchi, *i. e.*, numerous sibilant and fine moist râles in the lower part of the lungs; this catarrh is frequently accompanied by a certain amount of congestion of the pulmonary tissue. The cough, which is ordinary slight, attracts little attention; the expectoration is scanty, mucous and muco-purulent. The sputa which come from the throat are sometimes slightly tinged with blood.

In the third week, the morning remissions are more marked, and the fever takes on the subcontinuous or remittent type.

It is not till towards the end of the week that these morning remissions begin to exercise a perceptible influence on the state of the patient. The most of the grave symptoms of the second week continue with the same intensity, or are even more pronounced; and in many patients some of these symptoms only attain their complete development in this third period.

The patient is too weak to sit up in an erect position, and sometimes the body by its weight slides down in bed. The stupor may be so profound that the

patient no longer responds to questions, or takes notice of anything that goes on around him. He passes his urine and fæces involuntarily; there may even be retention of urine with enormous distention of the bladder.

The rose spots now begin to fade away. During this period there often appears an eruption of little vesicles filled with a transparent liquid (*miliaria crystallina, et sudamina*).

Finally, it is principally in this period that we are apt to see certain of those complications and sequelæ which have nothing specific about them, such as pulmonary congestion and bed sores.

In the fourth week, when the fever becomes intermittent and the evening exacerbations are less marked, the effects of the hyperthermia begin to pass off, and there is abatement of all the symptoms dependent on febrile excess. There is now an improvement in the state of the intellectual faculties of the patient, and natural sleep begins to return.

The tongue gradually becomes more moist, and more readily protruded, the sordes disappear, the tympanites and diarrhœa diminish. The stools have now more color and are solid. The spleen resumes its normal size. The pulse, little by little, regains its natural slowness and force. The temperature becomes equalized in all parts of the body. Sometimes there are abundant sweats.

Often as the patient recovers possession of his

mental powers, he begins to have realization of the gravity of his condition, and of his extreme weakness.

The weight of the body considerably diminishes during the disease; this loss of weight may exceed twenty pounds.

The period of convalescence is often disturbed by various complications and sequelæ. Divers causes temporarily bring back the fever; the patient may have too early left his bed, he may have partaken of solid food before the digestive organs were sufficiently strong to appropriate it, or may have applied himself too soon to work of mind or body, and hence suffers relapse.

When convalescence progresses without any drawbacks of this kind, the appetite becomes ravenous, and the patient cannot easily satisfy his hunger.

Patients sometimes experience a feeling of unusual mental and bodily well being, but the least effort soon fatigues them, and it generally takes months before the organic and mental functions have regained the vigor which they had before the attack.

The weight of the body sometimes undergoes a new diminution, even after the fall of the fever, for by reason of the increased strength of the heart's action there is an augmentation of the urinary secretion which carries with it all the waste matters accumulated in the organism during the long period that the circulation was embarrassed. The weight, however, soon begins again to increase, and owing to

the improvement of the appetite and the restoration of the digestive functions, this gain is rapid and may amount to from five to seven pounds a week.

In cases which terminate fatally, death takes place generally about the end of the third, or during the fourth week. The proximate cause of death is almost always the enfeeblement and paralysis of the heart, which are the consequences of the hyperthermia.

In these fatal cases the pulse becomes extremely frequent, 120 a minute and even more, and its force diminishes. By reason of the feebleness of the circulation, there are hypostatic congestions in the lungs and other parts of the body. The contractions of the heart muscle becomes more and more weak, and the patient succumbs to pulmonary œdema.

Death is more rarely the consequence of paralysis of the brain. In this event the cerebral symptoms due to the fever become more and more marked, and the patient dies in coma.

Many patients succumb to complications or secondary affections which are generally but the consequences of the fever and the tissue degenerations caused thereby; there is no more important factor in the production of sudden death than fatty degeneration of the myocardium.

PATHOLOGICAL ANATOMY.

The anatomical lesions observed at the autopsy

are of two orders. One group is the direct consequence of the typhoid poison; the other is referable to the general disturbances brought about by the poison, and especially to the fever, and is not peculiar to the typhoid infection.

The morbid processes which are the direct effects of the typhoid infection, are located chiefly in the lymphatic apparatus of the digestive organs. In the intestines, the poison exercises its action principally on the closed follicles of Peyer's patches, and on the solitary glands, more particularly those of the inferior part of the small intestine. The lesions occupy an average extent of from one to two meters, becoming less and less marked as the distance from the ileo-cæcal valve increases. In some cases, the solitary glands of the large intestine are also affected.

Under the influence of the bacilli which have penetrated the follicles, the mucous membrane is congested and swollen, and the glands of the intestine are the seat of an abundant infiltration, constituted by an enormous proliferation of cellular elements. Peyer's patches and numerous of the solitary glands form fungous-like projections of considerable size, of a reddish-gray color and soft consistence, which, especially in the neighborhood of the ileo-cæcal valve, extend beyond the limits of the patches, and end in becoming confluent.

This cellular infiltration reaches its maximum at the end of the first week. In milder cases, it

undergoes, partially or totally, absorption at a later day without entailing ulcerations; but in grave cases the infiltrated elements are soon smitten with a gradually progressing necrosis, and there are found, sometimes throughout the entire extent of the swollen patches, sometimes in a part only, sloughs which are stained by the bile a greenish-yellow or dirty brown color. This necrobiotic process is prolonged to the end of the second week. Little by little the sloughs are separated, fall off, leaving losses of substance of variable extent, involving the entire mucous membrane and extending down to the muscular coat which is left bare; this coat generally remains intact, but it is sometimes invaded by the destructive process. Towards the end of the third week, we see the ulcerations, whose long axis, like Peyer's patches, corresponds with that of the intestine, run together and become confluent.

Cicatrization begins in the fourth week, but complete reparation ordinarily demands a long time; and this is the more likely to be the case from the fact that it is not a rare thing to see at an already advanced period of the disease, along side of early infiltrations which regularly run their course, fresh infiltrations involving other patches, and passing through the same stages. In general, the first infiltrations appear in the neighborhood of the ileo-cæcal valve, and those which appear later are seated higher up in the intestine.

The scars of typhoid ulcers are generally recognizable after the lapse of several years, by the thinness of the mucosa, the absence of villi, and the presence of pigment spots. Stenosis of the intestinal canal, however, as a sequel of typhoid fever, is rarely seen.

In the mesenteric glands, and principally in those which receive lymphatics from the ulcerated portions of the intestine, morbid changes of the same nature are observed. The glands are swollen, and attain the size of a bean or hazle nut, sometimes are even larger. This swelling is due to cellular hyperplasia both of the parenchyma and connective tissue of the gland.

In the period of convalescence the glands regain their natural size, but occasionally certain spots undergo softening, by reason of a process of necrosis. The foci of softening which are thus formed are sometimes reabsorbed after a long time, and sometimes they leave behind a dry, caseous mass, which becomes encysted and undergoes the calcareous transformation.

To the direct and primary effects of the typhoid poison, we must also refer the lesions of the spleen, which consist chiefly in hyperæmia and proliferation of the cellular elements, entailing consecutively a considerable increase in size of the organ, an augmentation which may amount to double and even treble the natural volume. At the same time that the tumefaction is on the increase, the spleen is greatly distended

and of a harder consistency; later, its tissue softens and becomes more friable.

In the majority of cases, the immediate, direct effect of the infectious agent does not seem to extend farther. In other cases, however, the hypertrophy invades other glandular groups; and among those most frequently affected should be mentioned, in particular, the mesenteric glands of the upper part of the intestine, the retro-peritoneal glands, the bronchial glands, the follicles at the base of the tongue, and the tonsils.

It is possible also that certain complications depend on the direct action of the poison upon divers organs; perhaps to this category belong certain precocious pneumonias, certain acute nephrites etc. Pathologists have, moreover, determined by direct observation the presence of bacilli in the liver and kidneys.

Besides the anatomical lesions which are the immediate effects of the typhoid poison, the autopsy discloses in various organs alterations which are not caused by the poison itself, or are but the indirect consequence, and therefore have nothing about them which is peculiar to abdominal typhus, but are witnessed in all diseases attended with pyrexia of long duration.

The most frequent and most important of these alterations is the degeneration of the anatomical elements of certain organs. It is principally in the kidneys, liver, heart, striated muscles, blood-vessels,

and salivary glands, that pathologists observe this degeneration, which should be referred exclusively to the hyperthermia. These fatty degenerations, in fact, are only found in cases where the temperature of the body has been maintained a certain time at a high degree, and they are always wanting when the febrile elevation has been moderate.

Several of the functional troubles observed in this disease are the effects of this degeneration. Such are the cardiac asthenia, the cerebral disturbances which often continue after the fall of the fever, the excessive muscular weakness from which the patient suffers in full convalescence, the albuminuria, etc.

This tendency to processes of necrosis and tissue degeneration plays a large part in certain complications, such as bed sores and gangrene of the mucous membranes.

MILD FORMS.

The type which we have just described may be irregular and incomplete in two ways. There are cases which begin with the same appearance of gravity as the normal cases, but their duration is notably shortened. The fever ceases at the end of the first week, or during the course of the second, and the total duration of the disease does not exceed from eight to fourteen days. This is called abortive typhus (*typhus abortivus*).

In other cases, the duration of the disease is about normal, but the fever and the other symptoms are very mild. The temperature remains below 40° C. (104° F.), or only occasionally rises to this height: *typhus levis*.

Lastly, there are some cases which are distinguished from the normal form, either by their rapid evolution, or by the mildness of all their symptoms: *typhus abortivus levis*.

These abortive forms often begin suddenly, without any prodromes, by a chill and a rapid rise of the temperature. This mode of onset is also sometimes observed, though rarely, in cases where the disease has its normal duration.

In the mild forms and especially in the abortive forms, many of the characteristic symptoms may be wanting. It is rare that the spleen is not a little swollen, and that there are not some intestinal troubles. On the other hand, the rose spots are sometimes wanting. The infiltration of Peyer's patches may not be followed by necrosis, and when this does take place the eschars are quite circumscribed, and the ulcers remain small and superficial. Yet, however small may be their extent, these ulcers may attain considerable depth, and even determine perforation, but this termination is quite exceptional. These abortive forms were formally excluded from the category of abdominal typhus, and were designated under the names of *gastric fever*, *mucous fever*, *febrile intes-*

tinal catarrh, etc., but the fact has since been recognized by clinicians that it is really with an infection by the typhoid poison that one has to do in these cases. The mildness of the symptoms seems to be due to the fact that the organism on which the poison acts is more than usually refractory to its influence. Certain cases of apyretic abdominal catarrh, such as those so often observed in times of typhoid epidemics, seem therefore to be the expression of a very moderate degree of poisoning by the infectious agent.

DIAGNOSIS.

In typical cases, the diagnosis generally presents no difficulty. The course of the disease is eminently characteristic: the onset with a long prodromic stage, the slow and progressive elevation of the temperature, finally the continuous fever of a duration which surpasses that of all other diseases. We should mention also, as important diagnostic signs, the tumefaction of the spleen, the rose spots, and the abdominal troubles. It will not do to forget, however, that some of these latter symptoms may be wanting, and that we are not thereby warranted in saying that the disease is not typhoid fever.

The existence of catarrh of the small bronchi has a diagnostic value which is considerably less. The cerebral symptoms, to which a capital importance was once assigned, have of themselves only a relative value, as they are met with in all cases where the fever

is high and long continued, and they may, on the other hand, be wanting in cases of typhoid with but little fever.

The etiology must also be taken into consideration, when it is a question of diagnosis. In times of epidemic, and in localities where typhoid fever is prevalent, one will be warranted in regarding as typhoid many doubtful cases.

Certain secondary affections and complications may sometimes clear up the diagnosis, such for instance as intestinal hæmorrhages and perforations. On the other hand, a well pronounced nasal catarrh at the onset of the disease, or herpes labialis, should exclude all idea of abdominal typhus. To arrive at certainty in the diagnosis, it is necessary to make a complete examination of the patient, in order to make sure that he has none of those diseases whose symptoms present at the onset a resemblance to typhoid fever. If you were to neglect the examination of the thorax, you might mistake a case of pneumonia or even of galloping consumption (*phthisis florida*) for dothinerteritis.

Acute miliary tuberculosis is also sometimes confounded with typhoid fever. The mistake is not easy to make when there are marked meningeal manifestations. Tuberculous meningitis gives rise to cerebral symptoms of a special gravity, and even a careless observer would not fail to perceive that these brain manifestations do not depend on the fever alone. On

the contrary, when the acute tuberculosis is characterized by hardly any symptoms but an intense continued fever whose duration and persistency are sufficient to explain the typhoid condition, it is sometimes difficult to pronounce categorically as to the diagnosis.

When there is no prevailing epidemic, it is not always easy to distinguish abdominal typhus from typhus exanthematicus. There are also certain points of resemblance between the symptoms of typhoid fever and certain latent forms of pneumonia, certain forms of malarial fever, cases of pyæmia, puerperal fever, simple epidemic meningitis, endocarditis (notably ulcerous endocarditis), pericarditis, pleurisy, uræmia, etc. Every well-informed and careful physician will avoid the mistake.

There are certain diseases of infectious nature, very rare by the way, which it is extremely difficult to distinguish from typhoid fever. Such are, in particular, those epidemics of poisoning by spoiled meat, where a great number of individuals are smitten simultaneously (such for instance as occurred at Andelfingen, in the Canton of Zurich, in 1839, and at Kloten, in the same Canton, in 1778), and which have been mistaken by certain observers for epidemics of typhoid fever. It is certain that both from the point of view of the course of the disease and the anatomical lesions, these cases have a great resemblance to abdominal typhus. The distinction is not possible with-

out taking into account the etiology. In the future, the discovery of the specific bacilli may be of great help in diagnosis.

In the abortive forms, the diagnosis sometimes presents the greatest difficulties. When there are pathognomonic symptoms, such as the tumefaction of the spleen, the rose spots, the intestinal disorders, a positive opinion may be given, but when these signs are lacking it is only by making due account of the etiology that one may be able with more or less of probability to establish the diagnosis.

Of late there seems to be a tendency to refer all gastric fevers and febrile intestinal catarrhs to abdominal typhus, and regard them as abortive forms. It cannot, however, be denied that there are other factors of causation, other infections, capable of producing the complex train of symptoms characterizing the so-called gastric fever.

PROGNOSIS.

The prognosis depends, above all, on the power and intensity of the infectious agent.

The light, abortive forms do not generally present any danger, and a fatal termination, which is quite exceptional, is due to some unexpected complication, such as intestinal perforation.

In grave cases, the prognosis depends, on the one hand, on the character of the fever, and on the other, on the behavior of the patient in presence of

the fever, and on his resistance to the hyperthermia. As a general rule, the higher the temperature, the greater the danger, and the danger increases in proportion to the duration of the hyperthermia.

Cases in which the usual daily fluctuations are but little marked, the morning remissions but slight, are particularly grave, as well as those in which treatment by antipyretics—cold baths, quinine, antipyrine—has but a fleeting effect on the temperature, which speedily rises again to its previous height. On the contrary, the prognosis is favorable if marked remissions occur, either as a part of the natural course of the fever, or as the result of the treatment.

The condition and behavior of the heart give prognostic indications of great importance. As long as the pulse is of moderate frequency, and strong, there is nothing to fear from the heart, but when, without any particular reason, the pulse becomes very frequent (120 or more), the condition should be regarded as one of gravity, for this acceleration indicates a notable enfeeblement of the heart muscle. The prognosis must be regarded as still more gloomy, when at the same time there are other symptoms of an asthenic condition of the circulation, such as commencing cyanosis, symptoms of collapse, coldness of the surface and extremities, coincident with a high internal temperature.

The state of the cerebral functions is of but relatively little importance as an element of prognosis.

Disturbances, however profound, on this side, do not constitute an immediate danger, as long as there are no signs of paralysis of the heart.

Certain individual peculiarities should be taken into consideration as elements in prognosis, by reason of the influence which they have on the character of the disease, and on the resistance of the heart. With children (exception being made of the first year of life), the prognosis is more favorable than with adults. With old people, the elevation of the temperature is much less marked during the entire course of the disease, and consequently the cerebral symptoms are much less prominent. Despite this fact, the danger is much greater with this class of patients than with younger persons. After the age of forty, the prognosis begins to be more unfavorable, and the gravity of the prognosis increases with age.

The mortality seems to be a little greater in the female sex than in the male.

As regards constitution, it is to be remarked that the disease ordinarily presents much more gravity in corpulent than in lean persons. Lymphatic temperaments seem to be less affected than nervous temperaments, although this is due to the fact that the former temperament is characterized by torpor, and the subjective symptoms are less pronounced; the danger is really no less than with the nervous temperaments. It is generally in persons of lymphatic temperaments that we observe those forms of *walking typhus*, in

which the individual affected continues to pursue his ordinary occupations till an advanced period of the disease, and may not realize the seriousness of his condition till some unexpected complication, such as intestinal hemorrhage, makes its appearance.

Persons addicted to alcoholic excesses present a much feebler resistance to the effects of pyrexia than the temperate.

In pregnant women, the disease often provokes abortion, and pregnancy as well as child-birth are conditions which always justify an unfavorable prognosis.

Persons suffering from chronic diseases are generally exempt from typhoid, but when they are attacked, the prognosis (in consequence of their feeble vital resistance) is more unfavorable than in the case of robust individuals.

In persons affected with emphysema of the lungs, the fever is usually moderate, and most of the symptoms connected with elevation of the temperature are but little marked. The great danger in these cases is from paralysis of the heart. It is the same with diabetes (Griesinger, Bamberger, Gerhardt).

The existence of chronic catarrh of the small bronchi, pulmonary phthisis, and lesions of the heart renders the prognosis grave.

Lastly, the secondary affections and complications have more or less influence on the mortality, and ought to be taken into account as elements of the prognosis.

The mortality varies in a measure according to localities and according to the epidemic, and above all, according to the extension which is given to the word *typhoid*. If this term be made to include all cases of gastro-intestinal irritation, synocha—even much that is ordinarily classed as ephemera—the mortality might be regarded as relatively low.* On the other hand, if we take account only of typical forms, and include in our statistics only cases where the temperature has risen to 40° C., and where the fever has lasted at least twenty days, adding also all cases, without distinction, which have terminated in death, we attain by expectant treatment a mortality of 20 per cent. or more, by taking the sum of statistics of different countries. By the judicious use of the antipyretic treatment, this figure is reduced by one-half or even more.

SECONDARY AFFECTIONS AND COMPLICATIONS.

There is no disease which presents so great a variety and such frequent secondary affections and complications as typhoid fever. The greater number of these complications are, moreover, intimately allied to the anatomical lesions which are so generally found

*This consideration leads recent writers, as Guiraud, to regard the considerable difference which exists between the mortality from typhoid in the German and French armies, as explicable by the wider extension given to the term typhoid by certain German authorities. TRANS.

in connection with the disease, and constitute so marked an aggravation of the ordinary symptoms.

Intestinal hemorrhages are especially frequent. The rupture of blood-vessels which causes them is due in the onset of the fever to the parenchymatous infiltration; in the third week, to the separation of the sloughs; at a later day, to the extension of the ulceration. The presence of a little blood in the stools is of considerable prognostic importance, as it gives reason to apprehend a more abundant hemorrhage in the future.

When the quantity of blood lost is considerable, symptoms of collapse appear; these sometimes declare themselves before the blood has even been evacuated by the intestine. In these cases the face becomes pale, the extremities grow cold, and the internal temperature falls several degrees.

This collapse may have for its immediate effect to attenuate or even to dispel altogether the cerebral disorders, as is the case in all decided febrile remissions. The pulse may also become slower, but this amelioration is of only transient duration. The temperature soon begins to rise again, and the only result of the hemorrhage is considerably to enfeeble the resistance of the economy. When the pyrexia has been of long continuance prior to the hemorrhage, the patient is in imminent danger of paralysis of the heart. A rather free hemorrhage early in the disease is a complication very much to be dreaded, while a hemorrhage

at a late period of the fever, when there is no longer reason to apprehend the return of a high degree of pyrexia, is of less grave significance. In certain circumstances, hemorrhage occurring in the decline of the fever may even have an ameliorating effect; generally, however, death is the consequence of the hemorrhage, or of the collapse which it occasions.

The frequency of intestinal hemorrhages varies considerably according to the country, the season, etc. At the Basle hospital, from 1865 to 1871, this accident occurred in 7 per cent. of the patients affected with typhoid.

The fear that treatment by cold water baths might augment the frequency of hemorrhages, by determining congestions of the internal organs, does not appear to be well founded. Statistics, on the other hand, go to show that hemorrhage is becoming a relatively rare event since the introduction of the cold water. Nevertheless, the occurrence of intestinal hemorrhage does seem to contraindicate the external employment of cold water.

Perforation of the intestine may occur, whether at the moment of separation of the slough, when the gangrenous process has extended to the serous coat, or at a more advanced period by reason of extension in depth of the ulcers. When perforation takes place, the patient feels all at once a violent pain in the abdomen accompanied by profound collapsus, and a sub-acute general peritonitis sets in, which rapidly proves fatal. Death generally supervenes during the four days which follow the perforation, nevertheless, in some rare instances, the fatal issue is

deferred for several weeks or even months. Recovery is not even impossible, and examples have been cited. The presence in the abdominal cavity of gas, which causes enormous bulging of the walls of the abdomen (pneumatosis) and prevents the liver-dullness from being detected, is almost pathognomonic of perforation. This complication, as a rule, is observed in 1 per cent. of cases of abdominal typhus.

Cases of peritonitis have also been noticed without previous perforation of the intestine, when the inflammatory infiltration or ulceration has extended from the inner coats to the serosa. When the peritonitis is localized, it generally ends in recovery, but if it becomes general, the result is almost certain to be fatal.

Phagedenic (serpiginous) ulcerations, which while cicatrizing in certain points invade others, may also be the cause of late perforations. In other cases, they entail a febrile condition which wears out the patient. Recovery comes about very slowly, if at all.

A number of complications depend more or less directly on parenchymatous degeneration of the organs, and on the tendency to regression or molecular disintegration which manifests itself in all the tissues, and which is itself the consequence of hyperthermia of long duration. This tendency is particularly apparent in the case of wounds and ulcers, chancres, fistulæ, etc., existing in the typhoid patient, which take on a bad aspect, rapidly become larger

by extension of the ulcerative process, and are sometimes even attacked by gangrene. Under the same influence, insignificant causes which could have no injurious effect on well persons, may determine grave lesions, almost always of a gangrenous nature. Thus it is that simple pressure, exercised upon the sacrum by the recumbent posture of the patient, may give rise to formidable bed-sores, which spread in extent and depth, and show no tendency to limitation or cicatrization till after subsidence of the fever.

By reason of pressure of the teeth on the tongue and lips, gangrenous ulcers may invade these parts. Biliary calculi, which previously had given rise to no functional disorder, and which had remained latent, may determine ulceration and perforation of the gall bladder.

Those diphtheritic processes which are observed in the gravest cases of abdominal typhus, as well as in the malignant forms of the most acute infectious fevers, and which affect the mucous membrane of the intestine, pharynx and bladder, appear to be of the same nature and are developed under the same influence.

The laryngeal ulcerations of typhoid fever, which were formerly regarded as of specific nature, like the intestinal ulcerations, and as due to the direct action of the infectious agent, should be looked upon as the result of a simple necrosis of the mucous membrane.

When the disease terminates favorably, these ulcers rapidly cicatrize, although in some rare cases they provoke perichondritis of the cartilages of the larynx, or œdema of the glottis, and terminate fatally.

This peculiar condition, this vulnerability of the tissues seems also to favor certain inflammatory processes. Thus it is that we frequently observe as a sequel of typhoid fever, furunculi, suppurations of the lymphatic glands, subcutaneous abscesses, or abscesses in the intermuscular cellular tissue, suppurative parotitis, etc. In the muscles, by reason of degeneration of the fibres, it is not rare to see produced lacerations accompanied by hemorrhage, and resulting in diffused phlegmon. At other times a hemorrhagic diathesis is developed.

The *fall of the hair* during convalescence, as also the *marasmus* which is sometimes witnessed as a sequel of the disease, is to be referred to the disturbances of nutrition determined in all the tissues by the long continuance of the fever.

The *albuminuria*, which is very frequent in the grave forms, as it is, moreover, in all diseases attended with high fever, is in many cases the result of degeneration of the renal tissue, and disappears with the fever.

The true acute form of Bright's disease is much more rare, and when it manifests itself during convalescence it generally terminates in recovery; appearing, however, in the period of acme of the disease, it constitutes a very formidable complication.

The *jaundice* which is sometimes observed, is rarely the consequence of catarrh of the bile ducts, being generally a hæmatogenous icterus, dependent on hepatic degeneration. In rare cases, the entire symptomatology of grave icterus is observed.

Besides the usual cerebral symptoms, you will witness in some cases a particular state which I have designated under the name of cerebral excitation with depression of the temperature, and which is characterized at times by the symptoms of meningitis, at others by mental disturbances of maniacal or melancholic character, coinciding with a temperature notably inferior to the temperature corresponding to the period of the disease. When the fever advances towards a favorable termination, the temperature returns to the normal and the cerebral excitation subsides. It is only when the cerebral paralysis makes progress, and especially in the period of final agony that you will observe a hyperpyrexia of 42° C. and above. The high temperature in these cases is an almost certain sign of approaching dissolution.

As an occasional sequel, the attending physician will sometimes witness, as in all grave febrile maladies, a disorder of the intellectual faculties manifesting itself by delirium, and which usually terminates in recovery.

Several secondary complications and sequelæ are due to enfeeblement of the heart, and are only indirect consequences of the elevation of the tempera-

ture. To this group belong the blood stases, which, when they take place at the base of the lungs, give rise sometimes to simple hypostatic congestions, sometimes to splenization, in which the pulmonary tissue, intensely congested and œdematous, is no longer permeable to air, at other times to a true hepatization of inflammatory nature—a hypostatic pneumonia. These tendencies to blood stases begin, as a general rule, to manifest themselves in grave forms during the second or third week when the heart is becoming incompetent for its tasks. Pulmonary œdema is also very frequent in the final period, in cases where death is the consequence of paralysis of the heart.

The formation of clots in the heart is also one of the consequences of enfeeblement of the contractions of the myocardium. Clots originating in the right cavities and loosened from their point of attachment, are swept in the blood current to the lungs and form emboli in the pulmonary arteries with hemorrhagic infarctions, which may be the starting point of secondary pneumonia or pleurisy. Blood clots in the left side of the heart may in the same manner cause infarctions in the spleen, kidneys, and other departments of the greater circulation.

The feeble state of the circulation also favors the formation of thromboses in the large veins. It is chiefly in the crural, and more particularly in the left crural veins that this lesion is observed. This complication is not always attended with grave conse-

quences; a fragment of clot, however, may become detached and produce embolism of the pulmonary artery and thus result in death.*

In rare cases, especially such as are accompanied by dilatation of the ventricles, the cardio-vascular asthenia persists to a high degree during convalescence, and may give rise to general dropsy. A slight degree of œdema of the lower extremities at the beginning of convalescence is of frequent occurrence. Finally, it is also to this cardio-vascular asthenia that we must attribute in part the disorders of nutrition which so materially diminish the vitality and resistance of the tissues.

All the complications which are directly or indirectly dependent on the hyperthermia, are much more infrequent in cases where an antipyretic treatment has kept down the fever, and brought about marked remissions or intermissions.

It is not always easy to pronounce positively as to the origin and nature of certain complications which are only rarely observed in typhoid fever, and to decide whether they are purely accidental, or whether they are due to the action of the typhoid poison. It is probable that such complications may be due both to the typhoid poison and to other causes. Thus it is, that on rare occasions we witness the supervention of certain pleurisies, meningitis, and inflammations of

[* In 250 post mortems, Hoffman found 15 cases of hemorrhagic infarction of the lungs.]

other organs. *Lobar pneumonia* is relatively frequent. When it appears at a late period, or during convalescence, it is to be regarded as a purely accidental complication. But occasionally abdominal typhus begins by an attack of lobar pneumonia, and the characteristic typhoid fever symptoms do not manifest themselves till at quite an advanced period. In these cases, it is probable that the pneumonia is due to the direct action of the infectious agent on the lungs, and that the medical attendant has to do with an abnormal localization of the typhoid process (*pneumo-typhus*). This pneumonia reveals itself only by increase of the fever and by the physical signs of hepatization; the cough, the pain in the side and the characteristic expectoration are wanting.

Lobular pneumonia is often a consequence of catarrh of the small bronchi. This inflammation sometimes passes to the chronic state, and may even be the starting point of phthisis. At other times it terminates by gangrene. This termination is observed principally in crowded and badly ventilated hospitals. It is sometimes the consequence of a hemorrhagic infarction, caused by an embolus conveyed from some focus of suppuration or of gangrene.

Writers have also mentioned among the affections consecutive to typhoid fever, acute miliary tuberculosis, but such a sequel is very rare indeed.

The *exacerbations* which sometimes occur during the course of the disease are ordinarily due to the in-

vasion of new patches by the infiltration, and may be regarded as the manifestation of a new *psorenteric eruption*. When this new infiltration does not take place till after the disease has completed its evolution and the fever has entirely disappeared, it is called a *relapse*. One is not authorized in referring any return or reawakening of the fever to a relapse, till he has determined by a minute examination of the patient that there is no complication or sequela present to explain the fever. Relapses present the same symptoms and the same course as the primary disease, nevertheless the duration of the fever in the majority of cases is relatively shorter.

By the *fever of convalescence* we understand temporary febrile outbursts occurring from accidental causes in this period, and which are of too short duration to be referred to a relapse or to a secondary affection.

TREATMENT.

In the treatment of typhoid fever, prophylactic measures are of first importance.

When an epidemic of typhoid fever is already spreading in a given locality, it is a difficult matter, if not an impossibility, to prevent the dissemination of germs and their importation into new districts. We may, however, to a certain extent oppose the formation of new foci of contagion in neighborhoods, houses, or groups of houses, by carefully disinfecting

the dejections of patients by means indicated under the head of cholera, and by taking care that these dejections shall not be thrown into cess-pools, dung-hills and privies. When the disease is already prevalent, the capital point is to prevent its spread by the intermediation of privy vaults and drinking water.

First among prophylactic measures, we would place the thorough disinfection of all suspected objects. Articles of clothing, and all other objects which are of little value, should be burned. Things which it is desirable to save may be disinfected by being plunged into boiling water, or placed in a dry oven, and subjected to a high heat. Strong acids or alkalies may be employed, also alcohol, chloride of lime, permanganate of potash, carbolic acid, creasote, some of the metallic salts, in particular those of mercury and copper; and especially to be recommended is a concentrated solution of chloride of zinc and sulphate of iron. During the epidemic which prevailed in Basle in 1867, we took measures, with the concurrence of the police, to disinfect with sulphate of iron and crude phenic acid all the privy vaults of the city, and this was done every day in all the public houses, school houses, etc., and once or twice a week in all private dwellings.

“With regard to the disposal of the dejecta of typhoid patients. I have a porcelain bed-pan used, the bottom of which is strewed each time before being used, with a layer of sulphate of iron; immediately after a passage, crude muriatic acid is poured over the fæcal mass, as much as one-third or one-half of the bulk of the latter being used for that purpose. When it is practicable, the contents of the bed pan should be emptied into trenches dug anew every couple of days, and filled up when discarded; care being taken that they are not located in the vicinity of wells. Where nothing else can be done, the dejections must of course be emptied

into privy vaults, in which case they should be even more thoroughly covered with muriatic acid. Any of the under-clothing or bed clothing that is soiled during stools should be immediately immersed in water or in a solution of chloride of zinc, and should be thoroughly boiled within 24 hours."*

With regard to the prophylactic advantages of sewerage, the statistics of a large number of English cities show that the frequency of occurrence of the disease may be considerably lessened by efficient sewerage systems, and trials recently made in German cities have given the same results. In localities where it is not possible to have sewerage, a marked diminution in the spread of the epidemic has been attained by such thorough disinfection of privies as has been above insisted upon; such, for instance, was the case in the epidemic at Basle in 1867.

With regard to the danger of drinking water, too much care can not be taken during an epidemic that all water for drinking purposes shall be obtained from wells which are distant from the foci of contagion, as well as from fields that have recently been manured, and from dung-heaps; it is a good precaution to first boil the water before using it.

A kind of treatment that may be called really *specific*—which meets and destroys the pathogenic agent in the organism—is yet to be discovered. Among the numerous remedies which have some claim to be called *bactericide*, there is none hardly deserving of mention but calomel. In cases where it is possible to give this medicament early, before the end of the first eight or nine days for instance, in three or four doses of one-half gramme each, you will sometimes

* Zeimssen's Cyclopædia, Am. Ed., vol. 1, page 195.

succeed in materially abridging the duration of the disease.*

It is by the treatment called *symptomatic* and *expectant* that we obtain the best results. The end which we have in view is to give the patient the means to resist the disease, to moderate the severity of the symptoms, and to lessen the dangers as much as possible. But the symptom most to be dreaded on account both of its direct and indirect consequence is the hyperthermia, and the ANTIPYRETIC TREATMENT gives us the means of considerably lessening the

* "I have usually given calomel in doses of half a scruple, and afterwards of seven and a half grains, so as to administer three or four such doses in the twenty-four hours. The first increase of the diarrhoea soon subsides, and afterwards it seems to be less. *** In most, but not in all the cases, the administration of the first doses was followed by a distinct but transient lowering of the temperature. *** After having employed this method, now, on about 800 patients, I still feel that I have every reason to continue it, and to recommend it to others." (Leibermeister in Ziemssen's Cyclop., Vol. I, p. 200.) Bouchard, who has had considerable experience with the mercurial treatment of the early stages of typhoid fever, recognizes the fact that calomel has a certain specificity of action, in that it abridges the duration of the disease, but he insists that it lowers the vitality of the patient, renders convalescence slower, and predisposes to intestinal hemorrhages.

Bartholow and Wilson in this country have adopted with some modification the calomel treatment of the early stages of typhoid fever.

danger from this source. Wherever this treatment has been rationally carried out, the mortality of typhus abdominalis has been reduced by one-half and even more.

The antipyretic method does not lay claim to effecting complete disappearance of the fever, or bringing back the temperature constantly to the normal. Such a result would be impracticable, and certainly impossible in the grave cases. What it does aim to do, and all that it aims to do, is to transform a grave continuous fever into a much less dangerous remittent or intermittent. We are to endeavor less to combat the exacerbations than to render the remissions more marked and of longer duration.

The basis of this treatment is the direct abstraction of heat. Cold baths of 68° F. or even of a temperature lower than this, and of about ten minutes duration, seem best to fulfill this indication.*

* [The enthusiasm in Germany respecting the antipyretic treatment of typhoid fever by cold baths seems to have somewhat subsided of late. On the Continent, it is called the *method of Brand*, from Brand who, in 1861, first popularized the cold bath treatment, and which consists (according to Brand's practice) in giving from the very onset (including the prodromic period) a cold bath of fifteen minutes duration whenever the temperature mounts up to 39° C. (102.5° F.); these baths should be of temperature of from 18°–20° C—(64½°–68° F.) and should be repeated every three hours day and night whenever the rectal temperature reaches the above mentioned figure; Brand insisted on this condition that there should be

Cold affusions, employed at the end of the last century by James Currie and his followers, do not give as good results as cold baths, and are much more disagreeable to the patient. The envelopment of the whole body, with the exception of the feet, in a sheet wrung out of cold water has an effect resembling much that of cold baths, on condition, however, that the operation be repeated at short intervals.

As for warm baths at $33-35^{\circ}$ C. ($91\frac{1}{2}-95^{\circ}$ F.), cooled gradually by the addition of cold water

a fall of at least 1° after the bath, and if necessary colder water is added for that purpose, or the patient is kept longer in the bath. At the meeting of the Berlin Medical Society, Sept. 30, 1885, Senator "in summing up the results of the cold water treatment in those hospitals of Berlin where this method has been rigorously carried out, and comparing from the point of view of mortality these results with those obtained by himself in the hospital Augusta, where no exclusive treatment is enforced, showed that the mortality has been greater under the cold water treatment."

At the meeting of the Society of Internal Medicine held in Berlin, Jan. 18, 1886, Leyden affirmed that the advantages claimed for the rigid antipyrene treatment of typhoid fever were largely illusory. Fräntzel also stated that the results of hospital trials which had come under his observation were against the free use of cold baths in typhoid fever. (Guiraud.)

In France it is only the school of Lyons that now rigorously carries out the system of Brand; the great majority of medical authorities employ cold baths only as adjuvants to other methods of treatment, and rather for their stimulant effect *on the nervous system of circulation and respiration* than for antipyresis.]

down to 20° C. (68° F.), and even lower, such as are prescribed by Ziemssen, they also give good results, but ought to be of considerable duration. Warm baths at 30° C. (86° F.), which have been recently advised by Riess, also cause a fall of the temperature of the body, but only on condition that they be prolonged for several hours. A bath of so long continuance is to most patients much more fatiguing than a very short cold bath.

By means of lotions and applications of cold water, bladders of ice, cold drinks and lavements, cold water sprays over the surface of the body (a method recommended by Preyer), one can also obtain a certain lowering of the temperature, but when the fever is high and obstinate, the fall is so little pronounced and so transient that this mode of obtaining antipyresis is in reality of but little utility.

In placing the patient on water beds full of cold water or water mixed with ice and salt, a marked reduction in the fever heat may also be obtained (Quincke and Leube).

The most simple means to enable one to appreciate the effects of the antipyretic method employed is to take the temperature of the patient before and after the cold applications. If you find that the bath has not produced a sufficient fall in the bodily heat, the water should be made colder, and the duration of the bath should be prolonged.*

* The method of Bouchard (referred to by Guiraud, from whom we quote) resembles that of Ziemssen and Riess. He takes for his basis the temperature of the patient, and the bath is administered at a temperature of two degrees lower than this. The bath is then cooled down 1° every ten minutes till its temperature registers 30° C. (86° F.)

In order that the baths may produce the utmost possible febrile remission, and one that shall last a considerable time, they are given, by choice, at the period of the day when the temperature has a tendency to fall of itself, *i. e.*, in the night time, and especially after midnight. In accordance with this intention, a cold bath is administered, for instance, at some time between 7 o'clock in the evening and 7 o'clock in the morning; if during the evening, from 7 to 11 o'clock the bodily temperature attains or exceeds 40° C. (104° F.), a bath is given; this is followed by a second bath between midnight and 3 A. M., if the bodily temperature reaches 39.5° C. (103.5° F.), and

The patient is then removed from the bath, and this process may be repeated without fatigue to the patient four to eight times in the 24 hours. These baths cause, on an average, a fall in the temperature of about 0.90° C.; in the period of hyperthermia, *i. e.*, in the second week, the fall is not more than 0.4° or 0.5°, and sometimes is even less.

If the baths thus given do not sufficiently bring down the temperature, Bouchard has recourse to sulphate of quinine in the dose of 1 grm. (15 grains), morning and evening, during the first and second week, 1.50 grm. (22½ grains) during the third week, and 1 grm. (15 grains) in the fourth week.

But baths and quinine constitute only one of the elements of treatment adopted by Bouchard; he aims at procuring general antiseptics of the organism. He begins his treatment with calomel, which he administers during the first four days of the fever in the dose of 40 centigrams per day (about 7 grains) in pills of 2 centigrams each, which are given every two hours. Attributing a great importance to the absorption of the decom-

a third from 4 to 7 A. M., if the temperature marks 39° C. (103° F.). During the day, the fever is generally left to itself, and there is no interference unless the temperature rises to an abnormal height. It is a matter of common observation that the exacerbations are habitually less pronounced when the medical attendant has succeeded by antipyretic applications in procuring well marked morning remissions.

The formula for the application of cold baths may be considerably modified according to the state of the patient, and according to the greater or less obstinacy of the fever.

The old method, according to which the tempera-

posed and toxic products contained in the intestines of typhoid patients. Bouchard endeavors to obtain intestinal antiseptics by the administration of iodoform and charcoal, his formula is as follows:

R Pulv. iodoform, 1 gramme.
Ether sulph., 100 c. c.

Dissolve and add:

Carbo lig., 100 grammes.
Glycerin, 200 grammes.

M. Sig. A tablespoonful every 2 hours.

Under the influence of this treatment, it is claimed that the mortality is reduced to 10 per cent. and the course of the disease rendered relatively mild.

Guiraud calls attention, moreover, to the good results claimed by Vulpian with salicylate of bismuth in typhoid fever (3 drachms in 24 hours), and to the favorable experience of Dujardin-Beaumetz with carbon bisulphide water

ture was taken every two hours, and a bath ordered whenever the thermometer in the axilla registered 39° C. or 39.5° in the rectum, also gives good results, on condition that it be perseveringly carried out, and that the medical attendant shall not neglect to take the temperature and administer the cold baths in the night time.

The bodily heat may also be reduced by means of antipyretic medicines. It is better, however, to reserve these medicines for cases where the cold baths fail to cool down the bodily temperature, and where there are contra-indications for their employment, as for example where there is a tendency to hemorrhages.

Among the antipyretic medicaments, that which has been the longest in use is quinine, which may be given in daily doses of 20 to 45 grains administered in divided doses two hours apart, so that the whole amount may be taken during the 24 hours. The quinine is given preferably in the afternoon in order that the fall in the bodily heat determined by the medicine, and which is generally experienced eight to twelve hours after its administration, may coincide with the usual morning remission. The quinine is administered only every other day.*

* Sulphate of quinine was introduced into the therapeutics of typhoid fever by Broqua, of Mirande, in 1840. Chappotain, of St. Laurent, applied the method of Broqua at the Hôtel Dieu, in 1842. Pereira in his thèses made known the results of

Salicylic acid, given in the dose of 15 to 20 grains every two hours till from 1 to $1\frac{1}{2}$ drachms are taken, and the system is thoroughly brought under its influence, produces a fall in the temperature with greater certainty even than when quinine is administered. As the maximum of its action is sooner obtained than

this method. Boucher, of the Ville Jossy, in his inaugural thesis, insists on the utility of employing large doses, 30 grains at least. Monneret goes further and proposes to substitute for the miasmatic poisoning of typhoid fever, the toxic action of sulphate of quinine, hence he would give as much as 75 grains a day to a typhoid patient. Blache and Briquet report the good effects of this treatment in the case of children.

These tentatives were repeated in Germany by Vogt in 1858, by Wachsmutt in 1863, particularly by Liebermeister in 1867. The latter has insisted on the doses and the period of administering them. He gives from 30 to 45 grains a day in divided doses of seven or eight grains every ten minutes; he begins the administration of these doses about five o'clock in the afternoon. He obtains thus a reduction in the pulse and temperature, which persists from twelve to eighteen hours; he waits several days before repeating this dose. Liebermeister employs indiscriminately cold baths or quinine, but he prefers the latter medication.

Kaulich and Chapetal, of Vienna, employ Liebermeister's method in the typhoid fever of children, and they apply concurrently the refrigerant method and sulphate of quinine, which they associate in the following way: every day in the first part of the afternoon the child is wrapped in a sheet wrung out of cold water, then is given, in one full dose, seven and one-half to thirty grains of quinine (the child being supposed to be from four to ten years of age). This

with quinine, the best time to give it is rather late in the evening. When there exist any signs of failure of the heart muscle, it is necessary to be very reserved in the administration of this medicament.

Among the new antipyretics, I would call attention especially to kairine and antipyrine. I am in the habit of giving these medicines in such a way as to

mode of treatment is repeated every second day in cases of urgency; moreover, a careful alimentation is early commenced.

Lindwurm, of Munich, never exceeds 30 grains a day. Lassau, of Copenhagen, gives the same dose all at once from seven o'clock till nine o'clock in the evening. Hérard also employs sulphate of quinine, and goes as high as 45 grains a day.

Germain Sée uses sulphate of quinine and prefers it to all other antipyretics; basing himself on some experiments made with Bochart, he, in fact, considers sulphate of quinine as a heart tonic; he gives it in one large dose about seven o'clock in the morning.

Jaccoud also prefers quinine to salicylic acid. He gives the first day 30 grains of bromhydrate of quinine; the second day 20 grains and the third day 15 grains. The medicament is taken in substance in wafers, each containing $7\frac{1}{2}$ grains; the wafers are swallowed one after the other with ten minutes of interval. Jaccoud administers them in the morning when he wishes to lower the evening temperature, and in the evening when he wishes to lower the morning temperature, and with respect to this administration, he regulates himself according to the examination of the temperature of the patient.

Pawer employs doses much smaller, and never gives more than seven or eight grains a day.

obtain a marked remission of the fever, but I do not endeavor, as some advise, to keep the temperature of the patient all day long at a lower figure. Antipyrine in particular, in the dose of 15 grains every two hours till from 45 to 90 grains have been administered, has been found to be a very efficacious antipyretic.* [An-

Teisser has shown the danger of sulphate of quinine in large doses. According to him it is a hyposthenic medicament which certainly enfeebles the functions of the nervous system.

Laborde, in basing himself upon his experimentation, has shown that the massive doses of sulphate of quinine may determine in certain cases of infectious myocarditis grave accidents on the part of the heart. Dujardin-Beaumetz has also shown the danger of these large doses of sulphate of quinine. (Reprinted from *Clinical Therapeutics*, G. S. Davis, Detroit, page 389.)

* "According to recent investigations, kairine destroys the hæmoglobin, and it is to this that its antithermic power is due. It is the same with thallin, which is really the most powerful of antipyretics, for it produces its effects in the dose of from 25 to 50 centigrams, and has even caused collapse in the dose of 1 gramme.

"As for antipyrine, which thus far appears to be the most harmless of the antithermics, as it can be given in small doses up to 6 or 8 grammes in the twenty-four hours, without producing any toxic symptoms, it certainly causes a marked fall in the temperature, but this fall is only momentary, and the temperature rises again, as soon as the usage of the medicine is discontinued.

"Prof. Jaccoud, in a recent communication to the Acad. of Medicine (Oct. 27, 1885) condemns these antipyretics in

tifebrine (acetanilide) in five grain doses every hour till the fever falls, is a medicine now much in use, and is attended with good results.]

One of the leading indications in this disease is to guard against weakness and paralysis of the heart, and whenever any degree of enfeeblement of the heart's action is noted (and you are especially likely to see this in cases where the antipyretic treatment has not been employed), the temperature still remaining high, there is a demand for such means as may the most speedily and safely produce a febrile remission. Cold baths, when the asthenia is pronounced, are contraindicated, and the same may be said of the administration of salicylic acid and digitalis. On the other hand, there need be no hesitation in giving quinine in antipyretic doses. The application of a bladder filled with pounded ice to the precordial region may also have a favorable effect, especially when recourse is had to this means before the feebleness of the heart muscle is too marked. Besides these measures, re-

rather severe terms. They determine, he says, without doubt, a notable and constant depression of the temperature, but this depression is without any enduring benefit to the patient; it brings him no relief, and is only a source of fatigue and enfeeblement to him; a sterile, deceptive modification, and without any advantage whatever."—Guiraud.

Among other medicaments, digitalis and veratrum also have an effect on the temperature in typhoid fever, but are not to be recommended, as their action is not unattended with danger to the heart.

storatives and stimulants are demanded, and especially alcohol under the form of wine or brandy. If collapse should suddenly occur, camphor tea (made by adding a little spirits of camphor to hot water), hot punch, or hot wine, musk in two grain doses every hour, may be administered; subcutaneous injections of ether or whisky may be indicated, also rectal injections of camphorated oil.

For the grave cerebral disorders, an energetic cold bath treatment may be demanded. There are cases where the application of an ice bladder or cold affusions to the head are useful.

When the diarrhoea is too profuse it will be necessary to keep it in check by means of opium in small doses, or opium combined with various astringents.*

* Formulæ :

- (1) R Tinct. Opii.
Tinct. campb.
Tinct. capsici.
Tinct. catechu, ʒʒ 3 ij.

M.

Dose. Thirty drops in water when needed for diarrhoea.

-
- (2) R Tr. opii, f 3 ij.
Tr. catechu, f 3 vj.
Mist. cretæ co., f ʒ v.

M.

Sig. Tablespoonful when the diarrhoea is profuse.

When the meteorism is intense, applications of cold water over the abdomen, cold water in lavements, stimulating frictions with turpentine or menthol, the continuous application of turpentine stupes sometimes have considerable efficacy; the introduction into the rectum of a flexible rubber tube which should be made to penetrate as far as possible, will sometimes give exit to large quantities of gas.

Particular attention should be given to the urinary excretion; care should be taken frequently to percuss over the hypogastric region, especially in patients inclined to coma, and recourse should be had to catheterization whenever there is retention of urine.

If intestinal hemorrhage should supervene, opium should be given in doses sufficient to arrest peristalsis. Small doses often repeated may be given; generally 2 to 3 grains in the 24 hours are enough for the purpose. The abdomen should be covered with an ice bag. The ordinary astringents have but a feeble action, nevertheless many practitioners are in the habit of prescribing alum or tannin along with opium. Lavements are contra-indicated on account of their liability to promote peristaltic action; moreover such

-
- (3) ℞ Bismuth sub. nit., gr. x.
Pulv. opii, gr. j.

M.

For one powder, to be taken when required.—Tr.]

injections can rarely if ever reach the seat of the intestinal hemorrhage.

In cases of intestinal perforation, it is not absolutely necessary to abandon all hope, provided that all intestinal vermicular motion may be stayed for a time by means of opium. For this end opium (which is the sheet anchor) is given in powder in the dose of at first half a grain every half hour, then every two or three hours. The most complete quiet is enjoined as well as abstinence for a time from all food and drinks; thirst may be assuaged by means of little pieces of ice which the patient may be allowed to hold in his mouth. In general peritonitis without perforation, opium administered in the same way is the most efficacious remedy. The patient may safely be allowed to remain a week or ten days without a movement of the bowels.

Hypostatic congestions and bed-sores may be prevented most effectually by the antipyretic treatment. When bed sores have formed and are quite deep and extensive, there is often nothing better to do than to keep the patient constantly in a warm water bath, in which he remains suspended by means of belts or bands which pass under him. To the water of the bath a certain quantity of decoction of oak bark may be added.

As far as the hygiene of the patient is concerned it is essential that he should have the most complete physical and mental repose. He ought, during the continuance of the fever, and sometimes for a long

time afterwards, to keep his bed, and the attendant should insist on his using the bed-pan whenever desiring to evacuate the bowels or the bladder, and on no account should he be allowed to get out of bed and sit on the night chair.

The temperature of the room, which should be well ventilated, should be kept between 57°–64° F.

The diet of the patient during the entire course of the disease and a part of the convalescence, should be exclusively liquid. When the fever is high, the patient has no desire for anything but water or drinks of which water is the basis. Cold drinks may be given frequently but in small quantities. Pure water with or without ice, seltzer or other mineral waters, thin milk of almonds, wine and water, lemonade or other acid drinks, decoction of parched rice or barley where considerable diarrhœa exists, are the drinks which suit the best. The patient may also be allowed tea and coffee, weak gruels of barley or oatmeal, or milk boiled and reduced with water. [In some cases nothing is more suitable than pure milk freely administered from the beginning to the end of the fever, at least American practice has proved the utility of such a diet.]

When symptoms of debility and prostration manifest themselves, it will be necessary to sustain the forces of the patient by means of concentrated broths, expressed meat juice, beef peptonoids, Leibig's extract, and other similar nutrient preparations. Wine and

other alcoholic drinks may be given at all periods of the disease, even during the height of the fever. The physician should throughout be guided in the administration of stimulants by the previous habits of the patient, and the state of the heart. It will not do to begin the administration of solid food and especially bread and meat, till at a considerably advanced period of convalescence.

APPENDICES.

I.

TREATMENT OF TYPHOID FEVER IN THE HOSPITALS OF NEW YORK, BOSTON, AND MONTREAL.*

NEW YORK HOSPITAL.†

During the early part of this summer the routine treatment of typhoid fever in Dr. Peabody's wards, if the patient entered during the first ten days of the disease, was a calomel purge immediately followed by naphthaline in doses of ten grains every three hours. The first seven cases died (two having entered the hospital moribund), one of septic infection, one of acute mania, and the three others simply from the intensity of the poisoning, the lesion being very extensive.

Since August 14th we have had but one death in twenty-one cases—two of these are still sick, but doing well—of this number, thirteen have had absolutely no treatment *directed to the intestines*, eight have had naphthaline, and among these the one death occurred.

When the temperature rises high enough to make the daily average about 103°, antifebrin is given, either in large doses at long intervals, or in continuous doses of two grains every two hours during the day, and three grains every three hours during the night. Some patients have had two grains every hour during the day. In no case was any bad result noticed; on the contrary, the patients were quieter, slept bet-

* Medical News, Dec. 17th, 1887.

† Reported by Dr. George A. Richardson, House Physician.

ter, and temperature, pulse, and general condition were much improved.

Whisky is given when pulse, tongue, and condition indicate the need of stimulation, the amount varying from three to eight ounces during the twenty-four hours. Fluid extract of digitalis is added occasionally in small doses.

When there is insomnia, it is almost always relieved by morphine, generally given hypodermatically, as so many of the patients have a greater or less tendency to vomiting. In a few cases the bromides, or urethan have been tried, but not with such good results as morphine. In cases of delirium with great restlessness, hyoscin hydrobromate, given hypodermatically in doses of one-hundredth of a grain, has been tried with very good effect. It has been followed by several hours of quiet sleep.

Diet is of milk, patients taking generally from four to five pints daily. If the stomach is at all irritable, milk with lime-water, or peptonized milk is given. Some patients take beef tea well, and have from one to two pints of this daily in addition to the milk.

In a few cases nourishment by the rectum has been tried for short times, with the effect of relieving an irritable stomach. Laxative enemata are given every other day if patients have no movement from the bowels; and in almost all of our cases this has been necessary, as patients have been generally constipated, diarrhoea being the exception rather than the rule, during the summer just passed.

Counting three cases not already entered in this report, as they were not here during Dr. Peabody's service, there have been thirty-one cases treated here since last April, with eight deaths, a mortality per cent. of almost twenty-six. This very high rate is to be explained partly by the fact that several patients entered late in the disease, and in very bad condition.

ST. LUKE'S HOSPITAL.

In Dr. Francis Kinnicutt's wards the treatment is essentially general and symptomatic. During the past several years, when it has been possible to establish the date of the beginning of the disease, occasionally one or more moderately large doses of calomel have been given in the first days of the fever, but never with the result of *aborting* the disease. So many factors are involved that it is difficult to give a trustworthy opinion in regard to the alleged power of calomel given at the inception of the disease, *at least* to influence favorably its subsequent *course*. Naphthaline given in frequently repeated doses, to the amount of sixty grains daily, has also failed in any abortive effect.

Rest, quiet, fresh air, and a very carefully regulated diet of mixed liquid food constitute the general treatment. Increased fever and intestinal irritation frequently have been observed to follow the ingestion of large quantities of raw milk, and in such cases a reduced amount of peptonized milk has been given.

The symptomatic treatment may be summarized as follows: Urethan is considered by far the safest and most efficient hypnotic. Its not-sufficiently well recognized antipyretic properties increase its value. It is given in doses of thirty to forty grains, repeated in an hour or two, if necessary, to relieve insomnia. Believing that excessive diarrhoea has its source often in the presence of undigested food and in catarrhal inflammation of the bowel in addition to the specific lesion, the stools are carefully examined in such cases. The presence of curds demands a more careful regulation of the diet. A combination of naphthaline and bismuth has been found efficient in controlling the catarrhal inflammation and in correcting fetor.

Recognizing the fact that paralysis of the bowel and thereby obstinate constipation may proceed from a *deep* ulcera-

tion, laxatives are not given after the first week or ten days. Small enemata every other day are used to relieve constipation. Since the discovery of the new group of antipyretics, they have been employed, almost to exclusion of baths in any form, to control what is believed to constitute harmful, continuous pyrexia.

The general rule adopted is to give antipyretics only when the temperature reaches 103°. Kairin, hydrochinon, thallin, antipyrin, and antifebrin have been successfully used and their effects very carefully observed. As the result, antifebrin is at present almost exclusively employed. Very exceptionally have any ill effects followed its use.

For combating heart failure, alcohol is chiefly relied upon. Where heart weakness proceeds from degeneration of muscle fibre, a minimum effect may be expected from any method of treatment; if failure is chiefly due to impaired nerve force or influence, which is more often the case, the use of alcohol gives the happiest results. Alcohol is rarely given in the early stages of the disease, very commonly in the third and fourth week. Many cases are treated throughout, without its employment. Its use is restricted to combat special symptoms. Sir William Jenner's rule is largely the guide in its administration. "When in doubt in an individual case of typhoid fever, abstain from giving it; where there is a question of the larger or smaller dose, prescribe the latter."

Dr. Beverley Robinson's general treatment of typhoid fever is expectant; he does not believe that there is any known specific for this fever and is very doubtful as to the power of any drug, in use at the present time, to abort this disease. His treatment naturally depends upon the stage of the malady at the time it comes under his care, and whether it has a tolerably mild course without complications, or whether the disease from the beginning is marked by more than ordinary severity

and is accompanied by manifest departures from what is usual, and the complications indicate special severity of the attack, or march of the affection.

The cases of typhoid fever which he has treated during several years past, have been, as a rule, of moderate severity. Diarrhoea has not been very frequent, temperature rarely going beyond 104° at any time, and then only during brief periods, heart complications have been occasional, pneumonia rare, and nervous symptoms showing either ataxia, or great adynamia, in relatively few instances; he recalls not more than three or four cases of intestinal hemorrhage.

In the incipient stage of typhoid fever, a mild saline cathartic preceded by one or two grains of calomel, or double that quantity of blue mass, is prescribed. Later, and so long as the development of typhoid fever appears doubtful, small doses of aconite, ammonia, and spirits of Mindererus, or neutral mixture, are the means he employs to subdue febrile excitement. If fever still continues, with marked elevation of temperature in the afternoon, after a few days, and other symptoms point more surely toward the typhoid state, these agents are abandoned for tonic doses of quinine, milk diet, which is insisted upon, and occasional tepid sponging of the trunk and limbs with lukewarm water and vinegar. Complications are treated as they arise, bronchitis or pneumonia with tincture of iodine, turpentine stupes, or Corson's paint, to the chest walls; chloride of ammonium, moderate doses of digitalis, and moderate stimulation with whisky internally. If the heart becomes irregular or notably weak and frequent, or a blowing murmur shows itself at the apex, he now orders tincture of strophanthus in five-drop doses every six hours, besides using mustard poultices or dry cups to the chest, and beginning, continuing, or increasing the alcoholic stimulant. Nervous derangements are influenced favorably by ether in the form of pearls, by musk, or by a mixture of lavender, chloro

form, ammonia, and camphor. Hemorrhage is controlled with turpentine and opium. High temperature is controlled by antifebrin in five grain doses, repeated two, or more times, in the twenty-four hours, or whenever the body temperature goes beyond 103° Fah. in the axilla.

The diet is usually limited to milk during the duration of the fever. This is given to the patient every two hours, as much as he will drink; nausea, or disgust for food, being to some extent relieved by the addition to the milk of lime water, Vichy, or Vals water, or by the alcoholic stimulant administered at the time. If nausea persists and the patient becomes very weak and prostrate, dry champagne is given frequently in small doses. Occasionally, *black coffee* has worked wonders in bringing back to life patients who appeared almost moribund. Solid food, as a rule, is not allowed until all febrile reaction has been absent at least one to two weeks * * * He is now using with favorable results what is known as albuminoid food, which seems to be tolerated by the stomach and bowels more readily than beef peptonoids, or other preparations of a somewhat similar character. At a later period, if the albuminoid food and the beef peptonoids have been well supported, and, especially, if no recurrence of the fever take place, farinaceous food is permitted and a small quantity of the light meats once a day.

In very few patients has he found the necessity at any time to treat their febrile condition by means of *systematic cold bathing*, and he regards this treatment as ill-adapted to the large majority of typhoid fever cases met with in New York city, either in hospital or private practice. Whenever hypostasis of the lungs involves these organs in a considerable degree, he believes frequent inhalations of oxygen gas to be a measure of great practical utility in giving to patients some additional chances of preserving life otherwise imminently imperilled.

THE MASSACHUSETTS GENERAL HOSPITAL.

The plan of treatment of typhoid fever carried out in Dr. Frederick C. Shattuck's wards has again become chiefly a symptomatic one. This summer he tried in six or eight cases the administration of naphthaline, eighty grains a day in divided doses, ten grains of calomel being given immediately on admission to the ward. It has been claimed by some that early cases may sometimes be aborted in this way. One patient thus treated, presenting the important early symptoms, recovered in three or four days; and so did another who received no medicine whatever.

Among the points in connection with typhoid fever in regard to which we are still very ignorant is the question of fact. Does the disease ever abort spontaneously, or in consequence of treatment? Dr. Shattuck gave up the naphthaline treatment because he could not see that in cases in which it received a thorough trial it was productive of any good result, while in two cases it caused strangury, in one other hæmaturia.

This year he has also discontinued the systematic use of internal antipyretics, ordering them only when the temperature is very high and the patient very restless, or, in his judgment, suffering in some other way directly from the effects of the temperature. These indications are seldom present.

Diet. Six ounces of milk are given every two hours. If this is not well borne lime water is added, or the milk is peptonized; or, if there is no diarrhœa, animal broths are allowed. When the evening temperature reaches the normal point, patients who have been on an exclusive milk diet are given broths, then raw eggs, then light farinaceous articles, and meat is permitted toward or at the end of the first week of convalescence. Stimulants are given in such quantities as the

pulse, the tongue, and the nervous symptoms may seem to demand.

In cases characterized by constipation, a large percentage the past two years, a plain water enema is given every second day. For sleeplessness and diarrhoea opium is the main reliance. In intestinal hemorrhage opium is given in sufficient quantity to narcotize the patient, stimulants are used according to the pulse, and ergotine is injected under the skin. To moderate the temperature, stimulate the nervous centres, and promote the comfort of the patient he is sponged with water at a temperature of 60°-75° every two hours if the temperature is 103° or more; every three, four or six hours according to circumstances if it be below that figure. Sometimes alcohol, or alcohol and water is substituted for the plain water baths once or twice a day.

It will be seen by the above, that the aim in treatment is simply to conduct the patient to recovery, safely and as speedily as is compatible with safety. A certain percentage of patients receive neither drugs nor stimulants, a certain proportion stimulants only, and a certain proportion both drugs and stimulants.

Dr. R. H. Fitz during the past summer made a few attempts in his ward to test the asserted value of naphthaline in checking or overcoming the progress of typhoid fever. The remedy was used in three-grain doses every two hours during the first week of the fever. There was no evidence that any benefit resulted.

Although given in capsules, nauseating eructations were at times complained of, and the size of the capsule was inconvenient. The disadvantages being conspicuous, without any evident corresponding gain, the use of the naphthaline was soon discontinued.

Of the newly discovered antipyretic drugs, antifebrin was the one usually employed when there were special in-

dications for their use. The artificial maintenance of a low range of temperature throughout the course of the disease was not deemed important. If an elevation of 105° F. was reached, a sufficient quantity of antifebrin was given to lower the temperature four or five degrees. The production of chilly sensations was considered undesirable. A single dose of five grains often sufficed. If necessary this dose was repeated at intervals of an hour until fifteen grains were taken. Doses of three grains were found of great benefit in relieving the headache so frequently occurring in typhoid fever. There was no necessarily simultaneous falling of the temperature.

The routine treatment of all cases consisted in a carefully regulated diet and the use of cold sponge-baths every two hours. The diet was chiefly milk, as nearly four ounces every two hours as possible. If the milk was not well borne, it was pancreatized or mixed with lime-water. The use of the exclusively milk diet was maintained until the temperature remained normal for at least a week. Beef tea, strained soups, and broth were then added, and, in the course of three or four days, soft puddings, eggs, and bread.

In the third week of normal temperature there was no restriction as to diet, with the exception that the most nourishing and easiest digested foods were ordered.

Wine or brandy was given after the first week whenever a weak pulse or excessive nervous debility was present.

Dover's powder or morphine, urethan, and chloral were used as hypnotics, the former, where sleeplessness was accompanied with pain, the latter, where pain was absent.

Constipation was a frequent symptom, and was invariably relieved by enemata as often as once in three days. In one case, irrigation of the colon, twice daily, became necessary. During convalescence a change of diet was often an efficient means of insuring a normal evacuation.

Profuse diarrhoea was controlled by liquid preparations of opium, and intestinal hemorrhage was checked by ten minims of laudanum every two hours.

THE MONTREAL GENERAL HOSPITAL.

The cases of typhoid fever treated in Dr. George Ross' ward include a larger proportion of severe and very severe cases than perhaps elsewhere—the reason being that, owing to the great prevalence of the disease in Montreal at certain seasons, and to the limited accomodation, it is a necessity to refuse a considerable number and receive only those most urgently requiring care. If we come, therefore, to look at the mortality, this important fact must be borne in mind. Here, any method of treatment which will give results approaching the average in other places, must deserve confidence, seeing that we deal with carefully selected bad cases.

The treatment is based on what might be called an "intelligent expectancy." The diet is composed exclusively of milk and rice water. The amount of milk consumed daily is not considered immaterial. It is not prudent to allow, as is often elsewhere done, milk *ad libitum*. On the contrary, the daily quantity is strictly limited, in the case of adults, to three pints *per diem*. This amount is found sufficient to meet the wants of the economy, whilst the ingestion of more leads to the accumulation of feces and aggravation of symptoms. The milk is frequently diluted with rice water, or, if thought well, with lime water. When the stomach is weak, benefit is obtained by artificial digestion of the milk, but the great majority drink pure milk and appear to assimilate it without difficulty. It is a rule to nurses to supply fresh cold water or ice water to typhoid patients freely, and, during the height of the fever, pellets of ice to suck. When the patient is delirious or unable to make known his wants, he is still to have cold water given him frequently and freely. It is believed that strict attention

to this apparently simple item is really a matter of considerable importance. It is a fixed rule to allow no change from a milk diet until the patient's temperature has been normal both night and morning for at least eight consecutive days. During the early stages, and until a material fall in the temperature has taken place, cold sponging of the entire body is carried out every three or four hours, as the case may require: and constant cold is applied to the head by means of a coil through which ice water flows. These measures are relaxed as the temperature falls and the symptoms improve.

In mild cases, or even those of moderate severity but running a course approaching to the type, alcoholic stimulants are not given, except in small quantities during the later stages; but in all those showing a higher grade of fever, as marked by an elevated temperature and signs of vital depression, whiskey and brandy are employed in amounts varying with the special indications of the case. When the prostration is marked, and the nervous symptoms severe, stimulants are given freely.

As regards medicines, a favorite prescription is one containing gtt. ij each of acid. carbolic. pur. and tinct. iodin., well diluted in water, every two hours. It is a rare occurrence to meet with discolored urine from this remedy. No striking results follow its administration. In the later stages, quinine in tonic doses, with or without digitalis, is given. When a case is seen sufficiently early, a full purgative dose of calomel is found to be useful in unloading the *primæ viæ* and preparing for the siege. We find a large proportion of our patients constipated rather than suffering from diarrhœa. The bowels are never allowed to remain quiescent for more than three days at most. More generally two days only are allowed between evacuations, which, if necessary, are obtained by means of enemata. These are greatly preferred to laxative medicines. In approaching convalescence, great caution is exercised in administering a purgative, since rapid elevation would seem

sometimes to follow directly after even a dose of castor oil. The presence of prominent symptoms often leads to the medicinal treatment being, for the time, entirely directed toward counteracting them. For instance, if there be marked gastric irritability, bismuth, bicarbonate of soda, and such like drugs, with effervescent, are given. If the case be especially marked by bronchitis and pulmonary congestion, turpentine in emulsion is relied upon. If tympanites be considerable charcoal is found very useful, sometimes turpentine, together with limitation of the food for a time, and attention to the bowels. If muscular tremor, delirium, and insomnia are a marked feature, such remedies as camphor, valerian, and ammonia are given at frequent intervals. Of the complications, hemorrhage is treated by ice, gallic acid, digitalis, or lead and opium, and the external application of an ice-bag. In peritonitis (without perforation) opium is given in moderate doses, and without any bad effects. When perforation is known to have occurred, hypodermatic injections of morphia and hot applications.

The use of quinine in antipyretic doses, during the active stages of fever, has been entirely abandoned. In some of those unaccountable "excursions" of the temperature which we are apt to witness during commencing convalescence, full doses of quinine are used with very good effect. Of other antipyretics, antifebrin has had a moderate trial in this disease, by some members of the staff. The conclusion arrived at seems to be that the sudden depressions of temperature produced by the drug do not in any way modify the course of the fever, which only subsides at the same time as if this had not been employed. In some cases, decided antipyretic action could not be obtained from it. In others, its ill effects, cyanosis and cardiac depression, were witnessed, but not to an alarming degree.

II.

THE USE OF THE COLD BATH IN TYPHOID FEVER.

The employment of the cold bath as a routine treatment in cases of fever has only of late years come into vogue in this country; and even yet, it has been carried out but indifferently, and has not received the full amount of attention that it deserves. It is too often restricted solely to cases of hyperpyrexia and its full value as a great and powerful antipyretic agent has yet to be appreciated. One of the greatest obstacles in the way of its employment lies in the trouble and disturbance involved in the procedure; but even these are but minor difficulties in the path which cannot prevent its general adoption if it be really of such value as its supporters make out. Professor Liebermeister has long been known as one of the highest authorities upon febrile diseases; and his article on Typhoid Fever* in the new "Cyclopædia of Medicine" is one of the most valuable contributions to medical literature that have appeared in our day. We propose to review here the arguments which he adduces in this article in favor of the employment of the cold bath, taking occasion to point out in what direction his method departs from that usually followed in this country. The material he has had to work upon has, indeed, been vast; for, he tells us, in six years—viz., from 1865 to 1871—no fewer than 1900 cases of typhoid fever passed under his care at the hospital of Basle! For the purpose of comparison, however, between the cases treated prior to the general adoption of the cold-water plan and those subsequently so treated, Liebermeister takes but 1743 of those cases; of which, 861 were

*This was Liebermeister's first article.—Ta.

treated under the old *régime*, and 882—the total of the last three years—upon the new system.

Starting with the axiom that by "far the greater number of those who succumb to typhoid fever die from the effect, directly or indirectly, of the fever heat," Liebermeister points out that antipyretic therapeutics must form the basis of the rational treatment of this (as of any other) fever. And chief among all antipyretics is to be ranked cold water, of which the history of its introduction as a therapeutic agent by Currie in the eighteenth century, its subsequent neglect, and its revival on the Continent in comparatively recent times, is now too well known to bear repetition. Brand and Jürgensen, however, deserve to be remembered for the active part they took in the advocacy of this method, and to them Liebermeister accords all due honor. He then proceeds to give brief but clear directions as to the best means by which such treatment can be carried out, premising that, although the main object is the abstraction of heat from the body, the manner of performance should be such as produces the desired result with the least inconvenience to the patient. We know no work, except, that of Brand, wherein such rules are so precisely laid down as they are here. Authorities—in this country at least—differ as to the degree to which the water in the bath should be heated when the patient is first put in it—whether it should be, say, 90°, and then gradually cooled to 70° or lower; they also differ as to the duration of the bath—whether this should be prolonged until the temperature of the body falls to normal, or whether it should be comparatively short, and reliance be placed on the subsequent fall (which invariably occurs) in the temperature of the body. We have known cases where, in spite of the cooling of the water, the time taken in the fall of the body temperature has been so slow that the patient has been kept in the water for an hour and a half, supported by stimulants, taken out almost in a condition of collapse, and requiring the ap-

plication of external warmth to neutralise the depressing effects of the long immersion. Such treatment Liebermeister sternly discountenances, and, however much it may have produced the desired effect of reducing the temperature, it is surely at the expense of the patient. Moreover, in such cases, the action is often disagreeably sudden and severe, so that within an hour or two the whole process has to be repeated. The plan followed by Liebermeister is, in brief, this: The patient is wholly immersed in water at a temperature of 68° F. The duration of the bath does not exceed ten minutes, and in the cases of feeble persons the duration should even be reduced to seven or five minutes. A short cold bath, he avers, has a much better effect than a prolonged tepid one; except, again, in the case of very prostrate patients, for whom a bath of 95° gradually cooled to 72°, as recommended by Ziemssen, is to be preferred. The indication for the bath is the safe and sure one obtained by the thermometer, a temperature of 103° in the rectum or 102.2° in the axilla being the usual limit to be allowed before having recourse to the bath. The frequency with which the bath should be repeated is entirely governed by the same standard; and, other things being equal, the number of baths required will be in exact proportion to the severity of the fever, the severest cases requiring a repetition of the treatment every two hours; while in some instances, Prof. Liebermeister tells us, the total number of baths required by one patient during his stay in hospital exceeded two hundred. As a rule, however, four or eight baths per diem suffice.

We have dwelt thus fully on the directions of Professor Liebermeister because it seems to us of the highest importance that, if this treatment is to be introduced into this country with any measure of success, it can only be by the adoption of a uniform scientific method, and not by the restriction of the treatment to cases on the verge of death from hyperpyrexia, nor by a too blind adhesion to the belief that a mere reduction

of the temperature of the body to the normal is all that is requisite. Before, however, urging the general adoption of these measures, which would have to be applied in almost every case of fever, it is but right that the evidence adduced in its favor by Liebermeister be considered. This we may now proceed to do.

First of all comes the question of the effect of the bath on the course of typhoid fever itself. Does it in any way hasten the process of recovery, and help in the elimination of the poison? To this question a negative answer must, we think, be given. And at first sight even facts seem to point the other way; not that the duration of a first attack is retarded, but that it renders the patient more liable to relapse. Thus Liebermeister gives a percentage of relapses of 7.4 before the introduction of this treatment at Basle, as against 9.4 after the innovation; while the mortality in the relapse was five times as great. But he at the same time points out a fallacy in taking these statistics, which are based on the whole number of cases under treatment; for he says that formerly the mortality in the first attack was higher than now. Taking, then, only those cases in which a first attack has been passed through, the relative proportions of the two percentages are diminished, being on this basis as a 9:10.3, instead of as 9.4:9.4. It must be borne in mind that relapses may occur more frequently now simply because those patients would have died earlier had not the cold bath been employed. However, he believes the question to be an open one, the evidence being in favor of a progressive increase in the frequency of relapses *pari passu* with the more extended application of this method. The same fact has been noticed by Biermer.

One other question of great practical import in the use of cold water in typhoid is that which relates to pulmonary complications, so frequent and so baneful in their effects. Here the balance of statistical evidence adduced by Liebermeister is

strongly in favor of the treatment. Thus, using the same number of cases already mentioned, he has noticed that, whereas before the treatment, the frequency of pneumonia was 7 per cent., with a mortality among those so attacked of 50 per cent., since the cold-water treatment the average frequency of this complication has fallen to 6.4 per cent., and its mortality to 30 per cent. This diminution in the fatal cases of pneumonia is one of the strongest arguments in favor of the general adoption of this method. A like satisfactory and well-marked diminution in the frequency and mortality of hypostatic congestion and other pulmonary complications has also been noted, so that he says with truth that "affections of the respiratory apparatus occur rather more rarely and run their course with less severity under the cold-water treatment than under any treatment which is not antipyretic."

There is no need to point out further the value of the bath as a sedative—its marvellous effects in calming delirium and all the series of nervous symptoms attributable to high temperature—for these are well-known and have been fully insisted on by all those who have recorded cases of hyperpyrexia so treated. Nor is there any need to point out how it acts in steadying and controlling the action of the heart, changing in a brief space a feeble thready pulse into a moderately full, regular, and soft one. The simple fact that remains from the study of such advocacy as is here presented to us by Liebermeister is: that, of all antipyretic agents, the cold bath stands pre-eminent (over even other modes of cooling—as by affusion, the wet pack, etc.) both as to its certain action and as to its ready application. We can do no more than urge our readers to the perusal of this valuable and suggestive monograph.—*London Lancet*.

III.

3. OIL OF TURPENTINE IN TYPHOID FEVER.

Dr. George B. Wood was the first to introduce into this country the treatment of tympanites in typhoid fever by oil of turpentine. There are two conditions when turpentine is of value. About the end of the second week, the tongue sometimes becomes very dry, red, chapped, perhaps coated in the centre, with a brownish fur, and at the same time marked meteorism develops. Ten drops of turpentine every two hours during the day and every three hours during the night will, in the majority of cases, remove the threatening symptoms. Again, when the diarrhoea persists after the acute stage of the fever is passed, when the convalescence is protracted and evidently the ulcers of Peyer's patches are slow to heal, turpentine acts almost as a specific.

"My mode of giving the turpentine was as follows: If bronchitis were present, and even if diarrhoea complicated the case, I gave what was known as my turpentine mixture:

℞ Terbinthinæ olei, ʒ ij.
Liquoris potassæ, ʒ ij.
Mucilaginis acaciæ, ʒ iv.
Syrupi papaveris.
Syrupi floris aurantii, ℥ ʒ viij.
Aquæ camphoræ, q. s. ad. f. ʒ viij.

Fiat mistura. A tablespoonful to be taken every fourth hour, the bottle being first shaken.

Since I commenced that treatment, I have never lost any case of typhoid, from either bronchitis or diarrhoea, or from its sequelæ of ulceration or hemorrhage."—Dr. R. P. WHITE, Meath Hospital, Dublin.

IV.

THE COLD-BATH TREATMENT OF FEVERS.*

The modern use of cold applications in exanthematous and continued fevers may almost be said to date from Currie, who made a specialty of this treatment towards the close of the last century. Currie preferred cold affusions to cold baths. Then came Giannini, of Milan, about the beginning of this century, who employed cold baths, defended his practice on scientific grounds, and was the real founder of Brand's method. In 1812, Récamier, in the Hôtel Dieu, Paris, treated typhoid fever by cold baths; patients were kept fifteen minutes at a time in a bath of 68° to 70° F., and were given two or three baths a day. In 1822, Froehlich, in Germany, published a prize treatise on the treatment of acute febrile affections by cold water. He reported a number of successful cases, and claimed superior efficacy for this mode of treatment. About the year 1843, we find Scoutteten and the physicians of the Faculty of Strasebourg employing the hydrotherapeutic procedures of Priessnitz in typhoid fever; and, a few years later, Jacquez, of Lure, and Leroy, of Bethune, published valuable monographs on the refrigerant treatment of fevers.

The first work of Brand, who is distinguished by the precision and rigorousness with which he has conducted the hydrotherapeutic management of fevers, and whose name is now everywhere connected with this mode of treatment, was published in 1861; and since that date a succession of treatises from the same hand, from 1861 to 1867, have appeared on this subject. This method soon became generally adopted throughout Germany, where it was advocated by Liebermeister and

* Boston Medical and Surgical Journal, Feb. 2, 1888.

other of the leading medical authorities of that empire. It was introduced into France by Glénard about the year 1881, and has been the dominant therapeutic system at the hospitals of Lyons, although not adopted to any extent in the other French hospitals. It need hardly be said that the cold water treatment of fevers has never become popular in this country or in England.

At the onset of his clinical experimentation, Brand made use of affusions and of the partial half-bath of Priessnitz; in his later publications he abandons all these hydrotherapeutic procedures, and replaces them by the cold bath. The temperature of the patient is taken every three hours, night and day, and, whenever it is found to be above 103° F., the patient is plunged into a cold bath. Brand has claimed for this method, when carried out in all its rigorousness, and from the very inception of the fever, extraordinary results.

At the close of a series of *conférences* on "hydrotherapy" in recent numbers of the *Bulletin Général de Thérapeutique* and *Therapeutic Gazette*, Dujardin-Beaumetz, to whom we are indebted for the above concise summary of facts, takes up the cold-water treatment of fevers. The fact of a physiological depression of temperature, amounting to several degrees, under the influence of cold baths is unquestionable; the main question, however, according to Beaumetz, is whether this artificial bringing down of the fever heat does any good or not. This inquiry must be answered in the negative if it shall be found, on careful experimentation, that the production of heat in the organism is increased, rather than diminished, by the cold baths. It seems to have been sufficiently demonstrated that the danger from hyperthermia results not so much from the elevation of the temperature itself as from the exaggerated activity of the phenomena of organic combustion which produce this hyperthermia, and that the real indication is to combat this excessive thermogenesis. Whether cold baths fulfill this indication or not, must be determined by experimentation.

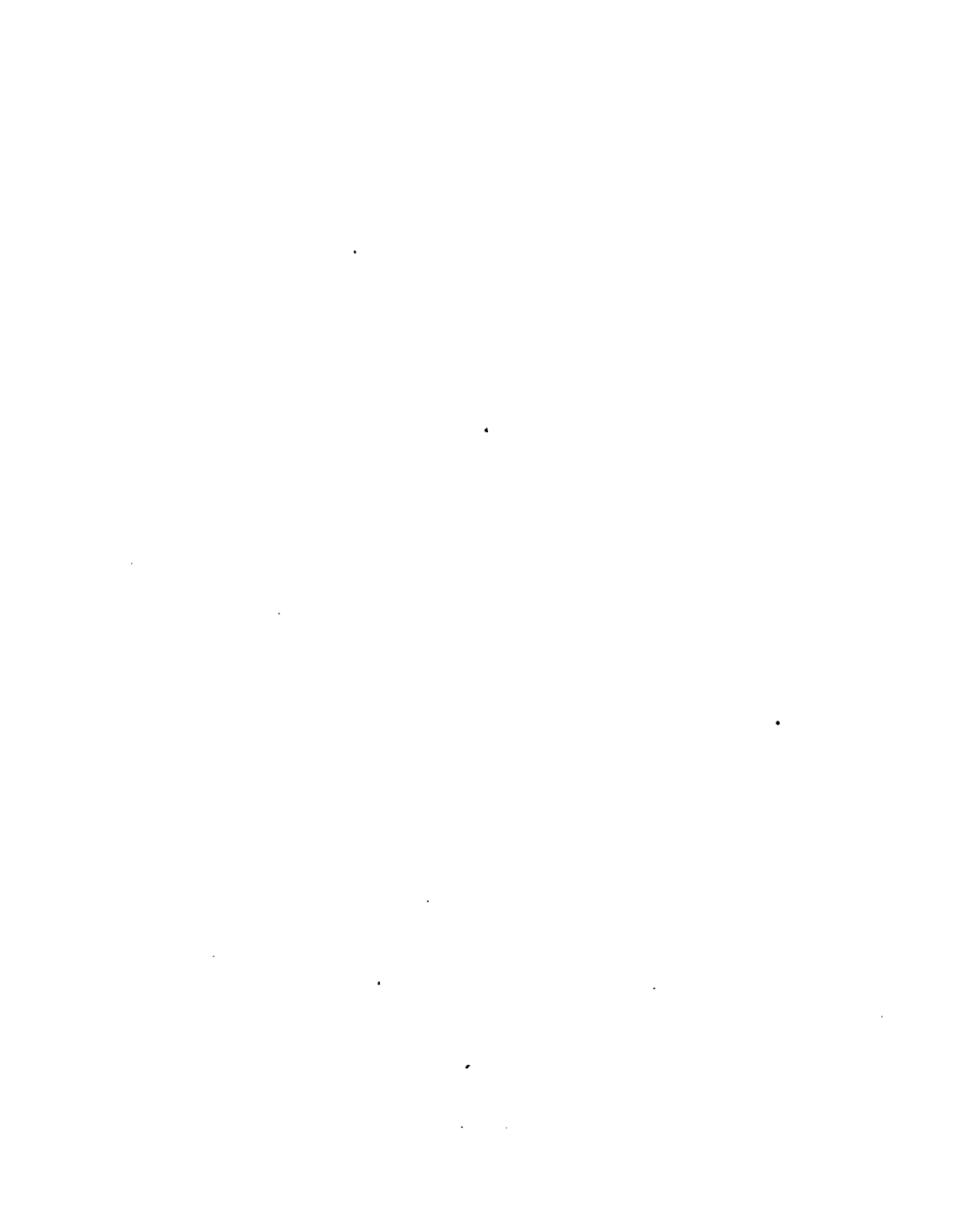
Within the past few years, careful series of experiments have been made by Frédéricq, of Liège, and by Quinquaud, of Paris, which seem definitely to have settled the dispute. Frédéricq made use of the well-known apparatus of Regnault and Reisset, devised for the study of the gases of respiration. He modified the apparatus so as to make it applicable to man, and has shown that cold, "when acting on the cutaneous surface of the human subject, markedly augments the absorption of oxygen and the production of carbonic acid, and, consequently, the production of heat." Frédéricq concludes that, far from slowing the interstitial combustions, cold powerfully excites them.

Quinquaud, by very careful experiments made on animals, confirms the conclusions at which Frédéricq had arrived by his experiments on man. He also proves that, under the influence of cold baths, both the absorption of oxygen and the elimination of carbonic acid are markedly increased. Then, taking up the study of the influence of cold baths on the elementary nutrition, by the aid of the simultaneous analysis of the gases of the arterial and venous blood of the peripheral circulation and of the right heart, Quinquaud finds that cold baths augment the activity of the interstitial combustions. Completing his researches by calorimetric studies, he has, lastly, shown that the heat-units emitted in a given time increase under the influence of cold baths.

"These accurate experiments," says Beaumetz, "ought henceforth to settle this question; and we are now warranted in affirming, as a physiological truth, that under the influence of cold baths the organic combustions are enhanced, on condition, always, that the refrigeration shall not exceed certain limits, and shall not reduce the rectal temperature of the subject under experimentation below 86° F."

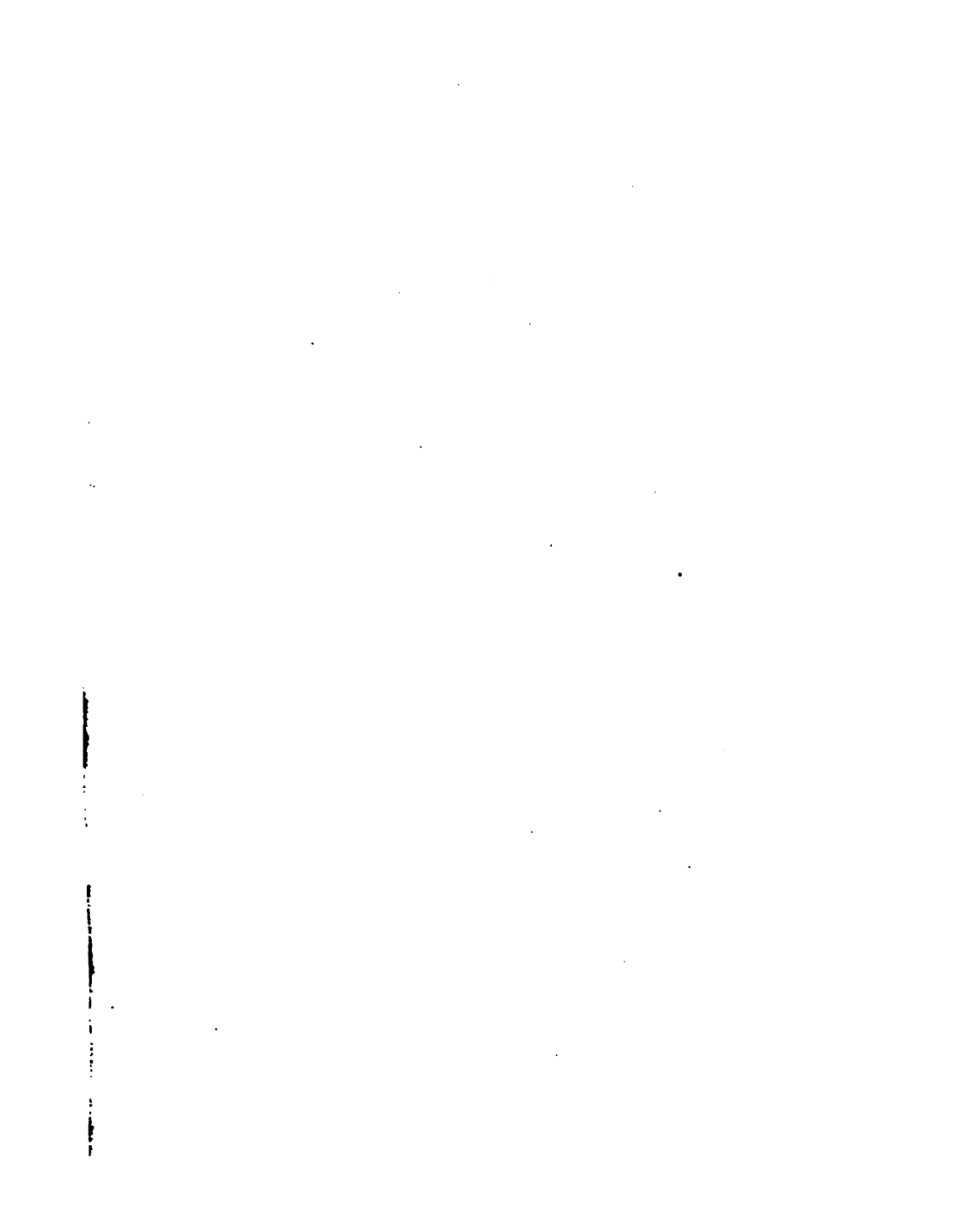
It would seem then, that apart from the tonic effects of the cold water treatment (which are doubtless considerable)

but a sorry benefit can be derived from a therapeutic method which increases the combustions of the economy. This it is that explains the superior efficacy of antithermic medicines such as antifebrine and antipyrin, which, in some as yet unknown way restrain thermogenesis. A ten grain dose of antipyrin, or half that quantity of antifebrine, given to an adult patient, and repeated every hour till the usual physiological effects are obtained, will bring down the pyrexial temperature quite as certainly as a cold bath, and with greater safety, comfort and benefit to the patient.









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